

ARCHIVES OF

*Physical Medicine
and
Rehabilitation*

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AMERICAN ACADEMY OF PHYSICAL MEDICINE AND REHABILITATION



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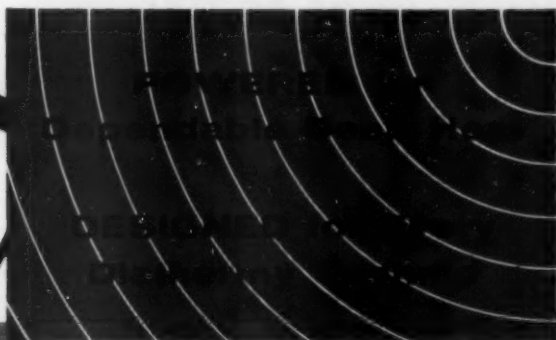
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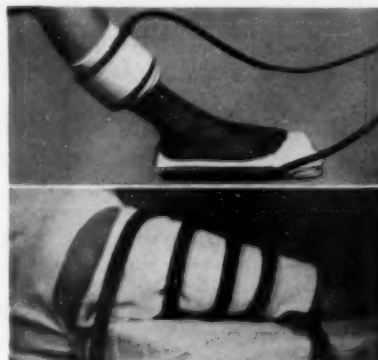
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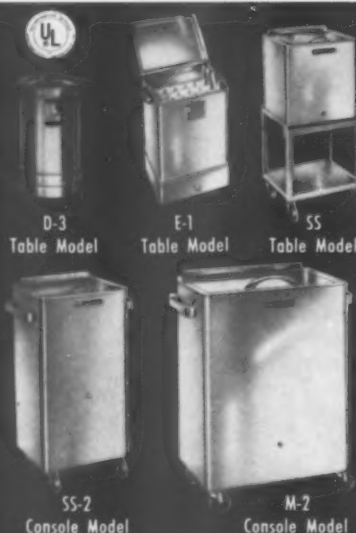
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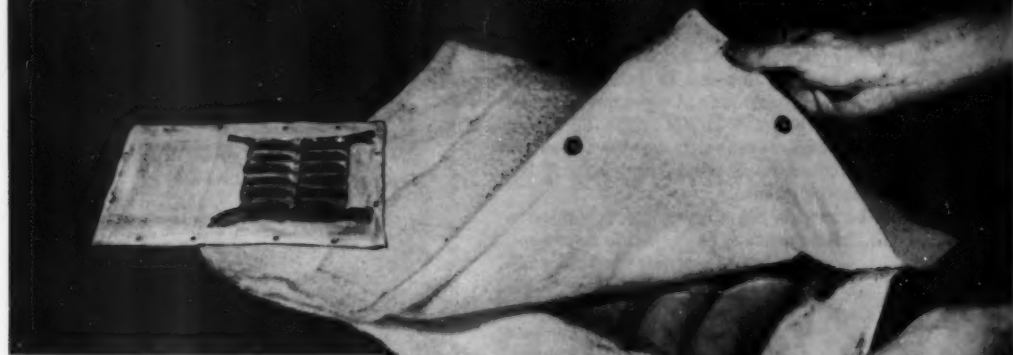
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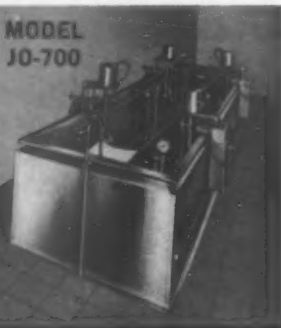
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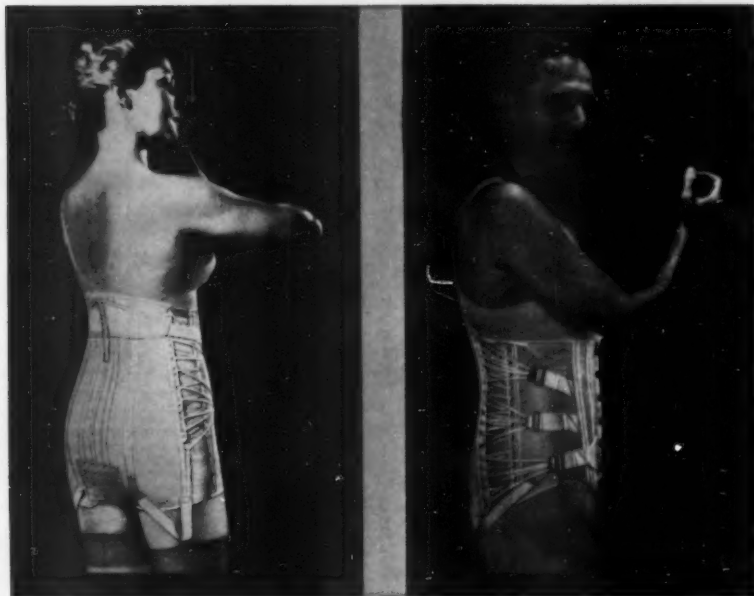
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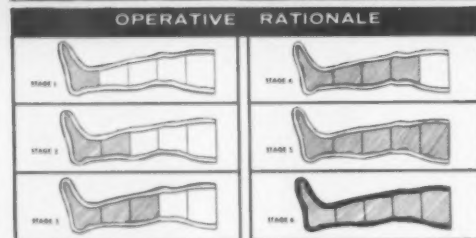
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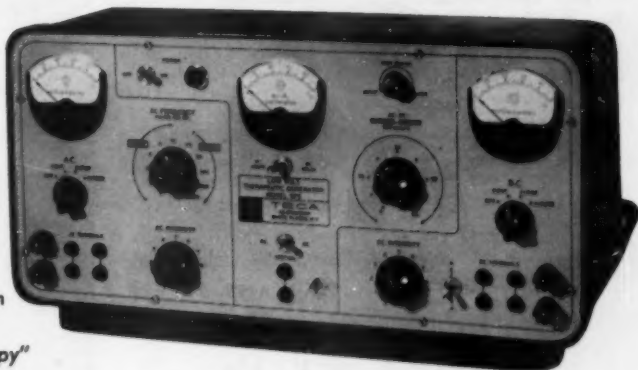
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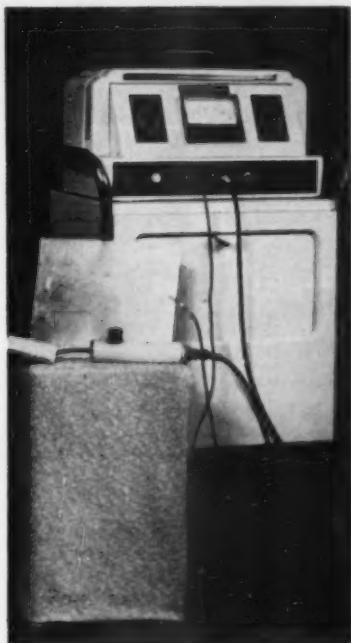


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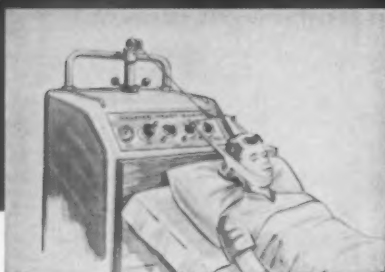
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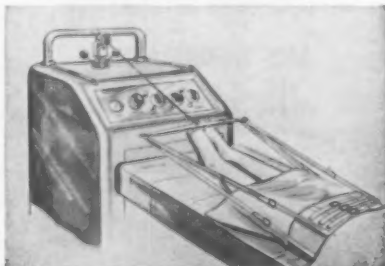
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A Study to Determine the "Energizing" Effects of Iproniazid (Marsilid) on a Group of Hemiplegics

Carmine Casella, M.S.
and
Jack Sokolow, M.D.
New York City

● A sample of 60 white males with hemiplegia on the right side were selected for inclusion in this study because of poor motivation for rehabilitation while inpatients in a physical medicine and rehabilitation service. The patients were tested on an overt level through physical ability scores and a covert level through Rorschach component scores and divided into two groups equated as to pretreatment scores on these measures. Thirty were included in the experimental group (iproniazid), and the remaining 30 were placed in the control group (placebo). Treatment extended over a six-week period. Upon termination of treatment, physical activity and Rorschach scores again were obtained and compared with the predrug scores. Significant gains were registered by the experimental group as demonstrated by the physical activity scores, while the control group showed no significant change at this overt level. Covert response measures as determined by the Rorschach scores showed no statistically significant change for either the experimental or control group. Possible explanations of this discrepancy between results of overt and covert measures are discussed.

In the last decade there has been a steady increase in facilities, both free standing and departments affiliated with general hospitals, which have had as their prime aim the restoration of the physically disabled to some realistic measure of their former functioning within the limits of their remaining abilities and untapped potential.¹ While this is the ideal in terms of goal, many patients who could benefit from physical medicine and rehabilitation's therapeutic programs simply are unable to avail themselves fully of the help offered to them.²

Many reasons of a psychological nature, such as situational depression, pre-morbid character structure and secondary gain, may underlie this inability to participate wholeheartedly.³ However, the one main cause that has been cited most frequently, regardless of the underlying reasons, is that of inadequate or insufficient motivation.⁴ Motivation, for the purposes of this study, is defined as a lack of incentive to engage in physical or mental activity on the part of the patient even when physically able to do so to some degree. Without a fair degree of motivation the patient is unable to participate actively in the rehabilitation process. Since the majority of the obstacles in this area, aside from physical disability, are of a psychological nature,

psychotherapy has been used.^{5, 6} Individual and group psychotherapy have been suggested and attempted with varying degrees of success.⁷ These efforts however have proved to be too time-consuming and generally impractical since the average stay for patients on this rehabilitation unit is about three months and thus is far too short to effect a major attitude change. It is thus readily apparent that there is a need to explore more rapid, albeit synthetic, means of activating patients to participate in the rehabilitation process.

Iproniazid (Marsilid) was selected for this purpose following a number of promising initial studies on its "energizing" properties in tubercular patients.^{8, 9} The drug is reported to be a potent inhibitor of monoamine oxidase and thus causes an accumulation of serotonin in brain tissue, resulting, it is hypothesized, in stimulation of the central nervous system.^{10, 11} Numerous studies on varied types of populations reported mood and behavioral improvement when treatment was extended for at least two months.¹²⁻¹⁴ These studies reported that the patients appeared more cheerful and manifested greater degrees of physical and mental activity following drug dosages which ranged from 10 to 200 mg. per day. In a more recent study, De Verteuil and Lehman¹⁵ found that, even for shorter treatment periods ranging from a minimum of 14 days, iproniazid proved to be similarly effective. The major difficulty encountered by these workers seemed to lie in the wide range of toxic side effects that accompanied the drug's use. Symptoms such as dizziness, hyperreflexia, neuralgia, postural hypotension and jaundice were those most frequently en-

Staff Psychologist, Department of Physical Medicine and Rehabilitation, Elmhurst General Hospital.

Director, Department of Physical Medicine and Rehabilitation, Elmhurst General Hospital.

countered.⁹ In undertaking this study, it was felt that these more serious consequences could be eliminated, or at least minimized, if the patients were selected judiciously and closely followed medically, holding drug dosages to a minimum level at which effects were demonstrated for the individual patients.

The following report presents the results of a pilot study to determine the effectiveness of iproniazid as an "energizer" on a sample of physically disabled patients.

Method

The sample consisted of 60 white, male inpatients on a rehabilitation service. All had hemiplegia on the right side. Disability onset ranged from three to eleven months, yielding a mean of six months for the total group. The mean age was 56.2 and extended from 46 to 72 years.

The main criteria for selection of patients to be included in this study was the staff prognostic assessment. This assessment was arrived at through the initial evaluation for admission to the rehabilitation service, as well as subsequent re-evaluations where the patient was seen by the entire staff and tentative, realistic and attainable goals were set. If the patient repeatedly fell short of accomplishing these prognostic goals because of poor motivation the patient was considered for inclusion in the study.

Two response measures for determining the effects of the drug were selected. A physical activity score was obtained, which was intended to demonstrate overt physical activity change. Secondly, several Rorschach component scores were obtained and were intended to demonstrate the more subtle covert changes.

The physical activity score was obtained through ratings by a physical therapist who segmented relevant patient activity into six objective components: (1) ambulation, (2) transfer activity, (3) exercises, (4) balance, (5) coordination, and (6) mood.¹⁰ These components were each rated on a five-point scale which ranged from zero, or very poor, to four, which was considered excellent.

For the covert measures a scale was devised, consisting of Rorschach components which were deemed valid in tapping pertinent areas. These were tabulated simply as frequencies. Specifically these areas concerned themselves with: (1) productivity, (2) degree of perceptual effort, (3) physical activity, (4) effect, (5) mood, and (6) perceptual accuracy.¹⁷⁻¹⁹

On the basis of the physical activity and Rorschach component scores, the sample of 60 subjects was divided into two equated groups: the experimental (iproniazid) and the control (placebo), each group having 30 subjects. In adhering to strict double blind procedure, no participating staff member except the study coordinator knew which patients were in the experimental or control group. Treatment was begun with administration of both iproniazid and placebo in dosages of 50 mg. three times a day. Several of the iproniazid group complained of dizziness by the end of the first week and one patient reported a "tingling in the back of the head." Drug intake was then reduced to 25 mg. three times a day for both groups and the side effects disappeared. After the six-week course of treatment with both 25 mg. of iproniazid and 25 mg. of placebo three times a day, the physical activity and Rorschach component scores were obtained again, and the postdrug scores were compared to the predrug or initial scores.

The specific hypotheses to be tested were:

1. Do the "energizing" effects of iproniazid manifest themselves at the overt level of physical activity? If so, then there should be a significant increase in the physical activity scores for the iproniazid group as compared to the control group.

2. Do the "energizing" effects of iproniazid manifest themselves at the covert level which projective testing taps? If so, then there should be a significant increase in the Rorschach component score for the iproniazid group as compared to the control group.

Statistical analysis of the data was accomplished utilizing Fisher's *t*.

Table 1: Pre- and Postdrug Means and *t*'s on Physical Activities Score for Experimental and Control Groups

Measure	Experimental (N=30)			Control (N=30)		
	Pre	Post	<i>t</i>	Pre	Post	<i>t</i>
Ambulation	1.20	2.86	2.52*	1.20	1.26	.89
Transfer activity	1.13	2.66	2.13*	1.20	1.33	1.05
Exercise	1.13	2.60	2.25*	1.20	1.26	.92
Balance	1.06	1.80	1.82	1.13	1.26	1.02
Coordination	1.13	1.86	1.76	1.14	1.17	.86
Mood	1.06	2.53	2.34*	1.06	1.10	.90

* Significant at .05 level.

Results

Table 1 presents the mean physical activity score for both the experimental and control groups, both prior to and following the drug interval. Of the total of six response measures studied, four are found to show a statistically significant increase over the six-week interval for the experimental group. In terms of magnitude, the postdrug mean scores were virtually double those for the pre-drug condition. The control group also showed some slight gains, but none of these increments reached an acceptable level of statistical significance. In view of the results obtained on the physical activity scores, the first hypothesis is supported.

In Table 2 are presented the findings for each of the Rorschach component

scores, analyzed in terms of the means of the frequencies for both the experimental and control groups. Quantitatively the differences between the pre-drug and postdrug conditions for both groups are slight. The largest increment is .47 for the productivity component in the experimental group. There was also one reversal for the physical activity component in the control group where the postdrug testing resulted in a decrement of the mean magnitude. None of these differences, however, was statistically significant.

Discussion

The findings in this study clearly demonstrate that iproniazid produces significant gains in the area of overt physical activity. The results of earlier work-

Table 2: Pre- and Postdrug Means and *t*'s on Rorschach Components Score for Experimental and Control Groups

Measure	Experimental (N=30)			Control (N=30)		
	Pre	Post	<i>t</i>	Pre	Post	<i>t</i>
Productivity	9.26	9.73	1.36	9.28	9.39	1.01
Perceptual effort	1.56	1.67	.83	2.10	2.25	1.08
Physical activity	2.26	2.40	.90	1.96	1.94	.59
Effect	1.06	1.13	.76	.86	.90	.73
Mood .....	.53	.66	.92	.68	.74	.78
Perceptual accuracy .....	.31	.39	.81	.32	.39	.82

* Significant at .05 level.

ers¹²⁻¹⁴ are supported. It is in the area of covert response that the data obtained in this study diverge from the results obtained by other researchers. The significant physical gains failed to be reflected equally at the level tapped by the Rorschach. To explain this fact, two alternatives are available:

1. Iproniazid may "energize" at the physical level but not at the personality level.

2. If iproniazid does affect personality, then the Rorschach, as employed in this study, is not sufficiently sensitive to detect the change.

To some extent this discrepancy may be attributed to features of the testing *per se*, namely that the Rorschach tends to reflect the more basic and pervading features of personality substratum and structure as opposed to the more transient states of the organism.¹⁸ Several workers have commented upon this aspect. Allport²⁰ specifically concludes that even the most pressing and apparently significant changes in relatively recent motivation states may fail to reveal themselves by indirect methods such as projective testing, in effect attesting to the weakness of this class of instruments.

A third explanation for the discrepancy between actual physical gains and the test findings may lie in the patients' own attitude toward their disability and their ability to perceive change in their disability status, consequently leaving them in their initial traumatic despair and depression. Their subjective perception tends to be less discriminating than the objective and impartial eye of the professional therapist who, by virtue of training and experience, is more sensitive to nuances of gain or loss in patient activity. The patient, on the other hand, being more intimately involved, unless demonstrating a spectacular change in disability status, fails to notice the lesser and more modest gains that are the building blocks of rehabilitation.

A fourth possibility that could have caused this discrepancy between overt and covert measures may lie in the relatively small quantities of the drug used and the short study period. Conse-

quently, the allegedly wider mood effects, elsewhere reported, may not have become fully manifest at the covert level.

Notwithstanding the difficulty of reconciling overt and covert assessment of the drug's effects, the experimental group as a whole did make a significantly greater amount of progress in the sphere of overt physical activity. Thus, aside from the expected gains under normal circumstances, iproniazid appears to have given a further activating impetus to the patients' recuperative progress in a rehabilitation program.

Summary

A sample of 60 white males with hemiplegia on the right side were selected for inclusion in this study because of poor motivation for rehabilitation while inpatients in a physical medicine and rehabilitation service. The patients were tested on an overt level through physical ability scores and a covert level through Rorschach component scores and divided into two groups equated as to pretreatment scores on these measures. Thirty were included in the experimental group (iproniazid), and the remaining 30 were placed in the control group (placebo). Treatment extended over a six-week period. Upon termination of treatment, physical activity and Rorschach scores again were obtained and compared with the predrug scores.

Significant gains were registered by the experimental group as demonstrated by the physical activity scores while the control group showed no significant change at this overt level. Covert response measures as determined by the Rorschach scores showed no statistically significant change for either the experimental or control group. Possible explanations of this discrepancy between results of overt and covert measures are discussed.

Acknowledgment: The authors are indebted to Phyl Kraut, RPT, Department of Physical Medicine and Rehabilitation, Elmhurst General Hospital, and to Mel Bishop, M.D., Director, Acute Intensive Treatment Center, East Louisiana State Hospital, Jackson, Louisiana.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



PLEASE NOTE . . .

Rehabilitation Service of Stanford University School of Medicine in Palo Alto, California wishes to call to the attention of the readers of this journal that the work reported in the article "Development of the Provocational Unit: Stanford Rehabilitation Service," by Martin Acker and David A. Thompson, which was published in the May, 1960 Archives of Physical Medicine and Rehabilitation, was supported in part by a grant from The National Foundation and also in part by a grant from the Albert and Mary Lasker Foundation.

Condensation of Symposium on Mouth-To-Mouth Resuscitation (Expired-Air Inflation)

Ralph E. DeForest, M.D.
Chicago

● Research, reported in this symposium, indicates that resuscitation with expired-air breathing is simple and effective. It is especially useful in cases of injury to the body. It is adaptable to infants, children and adults without adjunct equipment. With adjunct equipment it is adaptable to many specialized resuscitation problems, such as in contaminated atmospheres. Expired-air breathing should be performed with inflation volumes about twice the resting tidal volume of the victim at a rate of 12 to 20 per minute. Reserves of pressure and volume can be mustered easily to overcome unusual handicaps. The removal of carbon dioxide and the supply of oxygen can be kept within safe limits. Rescuers can maintain mouth-to-mouth breathing for an hour or more without fatigue even though the victim is physically larger than the rescuer. Obstruction of the airway above the larynx is the most common cause of failure of any method of artificial respiration. In expired-air breathing, this type of obstruction is prevented because the hands are free to keep the head extended at the atlanto-occipital joint and the lower jaw displaced forward. If there is an obvious mechanical obstruction in the airway, the first step is to remove it. If there is no obvious obstruction, mouth-to-mouth breathing is begun at once. It permits breath-by-breath assay of the presence of obstruction, degree of inflation, and degree of relaxation of the victim's chest. Techniques, requirements and results are elaborated upon in this condensed study.

This article is a condensation of the Symposium on Mouth-to-Mouth Resuscitation¹ which was sponsored by the American Medical Association's Council on Medical Physics. The Symposium comprises four articles:

(1) *Introduction*, David B. Dill, Ph.D., Edgewood, Md.²

(2) *Mouth-to-Mouth Versus Manual Artificial Respiration for Children and Adults*, Archer S. Gordon, M.D., Ph.D.; Charles W. Frye, M.D.; Lloyd Gittelson, M.D.; Max S. Sadove, M.D.; and Edward J. Beattie, Jr., M.D., Chicago.³

(3) *Oxygen and Carbon Dioxide Exchange and Energy Cost of Expired Air Resuscitation*, James O. Elam, M.D.; David G. Greene, M.D.; Elwyn S. Brown, M.D.; Buffalo, and John A. Clements, M.D., Edgewood, Md.⁴

(4) *Ventilatory Efficacy of Mouth-to-Mouth Artificial Respiration*, Peter Safar, M.D., Baltimore.⁵

In the Introduction to the Symposium, a brief history of the research to evaluate the various methods of artificial respiration is presented by Dill.² He states that all authors of the papers comprising the Symposium exchanged ideas and findings

while their work was still in progress. Although there is not complete agreement on all aspects, the areas of disagreement are small and of minor importance. The most active groups furthering this research work were: (1) Office of the Surgeon General, Department of the Army; (2) National Academy of Sciences-National Research Council (NAS-NRC); (3) American National Red Cross; (4) Army Chemical Corps; and (5) Dent Family Foundation. The Introduction to the Symposium is concluded by the following summary statement agreed upon by the contributors to the Symposium.

Summary

Resuscitation with expired-air breathing is simple and effective. It is especially useful in cases of injury to the body. It is readily adaptable to babies, children, and adults without adjunct equipment. With adjunct equipment it is adaptable to many specialized resuscitation problems, e.g., use in contaminated atmospheres.

Expired-air breathing should be performed with inflation volumes about twice the resting tidal volume of the victim at a rate of 12 to 20 per minute. Reserves of pressure and volume can be mustered easily to overcome unusual handicaps. The removal of carbon dioxide and the supply of oxygen can be kept within safe limits.

Rescuers can maintain mouth-to-mouth breathing for an hour or more without fatigue even though the victim is twice the size of the rescuer.

This condensation of a symposium sponsored by the Council on Medical Physics of the American Medical Association was prepared by Ralph E. DeForest at the request of the Editorial Board of the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION.

Dr. DeForest is Secretary of the A.M.A. Council on Medical Physics. Rolf Rattay, Council staff assistant, assisted in preparing the condensation.

Obstruction of the airway above the larynx is the most common cause of failure of any method of artificial respiration. In expired-air breathing, this type of obstruction is prevented because the hands are free to keep the head extended at the atlanto-occipital joint (sniffing position) and the lower jaw displaced forward.

If there is an obvious mechanical obstruction in the airway, the first step is to remove it. If there is no obvious obstruction, mouth-to-mouth breathing is begun at once. It permits breath-by-breath assay of the presence of obstruction, degree of inflation, and degree of relaxation of the victim's chest.

Skillful performance of expired-air breathing is an easily learned, lifesaving procedure. It has revived many victims unresponsive to other methods and has been proved in real emergencies under field conditions. Information about expired-air breathing should be disseminated as widely as possible.

General Requirements Pertaining to Research Studies

General Requirements for Evaluation of Resuscitation Methods. According to Gordon,³ controlled comparative studies are needed for the objective evaluation of various methods of artificial respiration. Such studies require that the test subjects resemble victims in need of artificial respiration; i. e., they are unconscious and apneic. All methods of artificial respiration under consideration must be compared under the same circumstances and on the same subjects.

Oxygen and Carbon Dioxide Exchange with Expired-Air Inflation. Elam⁴ gives simple calculations to show that victims can receive adequate oxygenation and carbon dioxide removal by expired-air inflation, a form of intermittent positive pressure breathing. The average minute volume of normal rescuers is 5,000 cc. This volume of air contains about 1,050 cc. of oxygen. The rescuer extracts 300 cc. of oxygen for his own use and leaves 750 cc. of oxygen in the exhaled breath for use by the victim. If the rescuer increases his minute volume to 10,000 cc. of air, his exhaled breath will contain

about 1,800 cc. of oxygen for use by the victim. The carbon dioxide concentration of this exhaled breath is about 2 per cent. Therefore, under these conditions, the victim receives around 9,700 cc. of exhaled breath having an oxygen concentration of 18.5 per cent and carbon dioxide concentration of 2 per cent.

According to Gordon,³ double to triple tidal volumes, resulting from rescuer-hyperventilation, are desirable to overcome initial hypoxia and hypercapnia of the victim. In studies by Safar,⁵ adept—but untrained—laymen were able to maintain respiratory rates of 12 to 20 per minute with tidal volumes of 1,000 to 2,000 cc. for periods up to 30 minutes without ill effects due to hyperventilation. Dizziness or other effects of hyperventilation can be counteracted by slowing the rate of respiration or by taking one normal breath each minute.

Research Studies

Methods of Artificial Respiration Studied. The following methods of artificial respiration were studied and compared:

1. Expired-air insufflation*
 - (a) Mouth-to-mouth
 - (b) Mouth-to-nose
 - (c) Mouth-to-mask (anesthesia face mask)
 - (d) Mouth-to-airway (oropharyngeal airway)
 - (e) Mouth-to-tube (endotracheal tube)
 - (f) Mask-to-mask
 2. Back-pressure arm-lift
 3. Back-pressure hip-lift
 4. Chest-pressure arm-lift (Sylvester)
 5. Manual rocking (children and infants only—in prone and supine positions with various degrees [angles] of rocking)
- "Victims" and "Rescuers."* The various studies presented were performed on a total of 62 adults and 9 infants and small children. All were anesthetized and rendered temporarily apneic by succinylcholine chloride or curare. In two of the studies, the subjects were rendered apneic by hyperventilation in addition to the drugs. No significant hypoxia was

*Masks, oropharyngeal airways, or endotracheal tubes facilitate expired-air insufflation, but their use is not considered essential to adequate performance of this method of resuscitation.

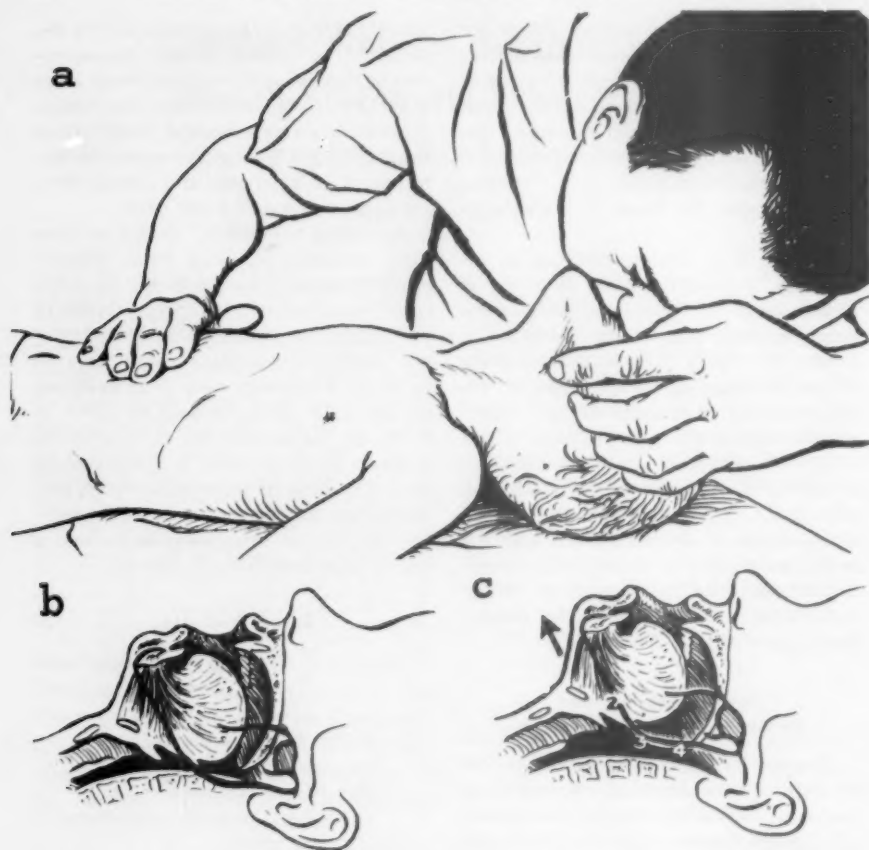


Fig. 1—Technic for children. (A) Rescuer places mouth over mouth and nose, and breathes into airway. (B) Airway obstruction with relaxed jaw. (C) Airway is cleared when jaw is extended.³

allowed to occur in any of the studies. Several mechanical "dummies" (systems) were utilized to simulate victims with "tight" bronchoconstricted chests. These "dummies" offered far greater resistance to air flow than ordinarily encountered in emergency resuscitation cases. The rescuers included professional medical persons, or paramedical and lay personnel. Only a portion of the paramedical and lay personnel had received previous training in resuscitation.

According to Elam,⁴ healthy rescuers should be able to perform expired-air resuscitation without restrictive fatigue and to be able to exert the necessary pressure to inflate lungs, despite such possible obstacles as bronchoconstriction and lesser compliance of the victim's thorax. To

double the average rescuer's tidal volume requires only 20 per cent of his vital capacity, and blowing this tidal volume into the victim ordinarily requires only 15 per cent of the available expiratory pressure. On the other hand, the rescuer can readily avoid furnishing the victim excessive volumes and pressures by watching the victim's chest and by using his (rescuer's) proprioception. Cardiovascular impairment can be minimized in both adults and children by timing the breathing so that inspiratory duration occupies one-third and expiratory duration two-thirds of each cycle. Shallow, spontaneous breathing can be augmented by brief, but large, puffs of air blown into the victim's mouth immediately after onset of each inspiration. For newborn or tiny infants,



Fig. 2 — Techniques of (A) mouth-to-mouth and (B) mouth-to-nose resuscitation. Inspiration is shown in A1 and B1. Expiration is shown in A2 and B2.

insufflation with small "puffs" of air from mouth and cheeks is recommended.

Technics of Mouth-to-Mouth Resuscitation. Gordon, et al,³ recommend the following technic for *infants and children*.

1. Clear airway.
2. Place victim in supine position with head extended and lift jaw so that it juts out into a position of prognathous.
3. Place mouth over mouth and nose of victim and breathe into airway.
4. If desired, move one hand to the epigastrium to exert a continuous, moderate pressure after patency of airway is established.
5. Keep jaw in elevated position at all times, even if this requires both hands.
6. Maintain a rate of at least 20 inflations per minute. (See fig. 1.) Technics for adults recommended by these authors are shown in figure 2.

Elam⁴ recommended the following basic steps in mouth-to-mask resuscitation for *adults*:

1. Clear mouth and throat.
2. With patient supine, elevate mandible.

3. Apply lips to mask and inflate victim's chest.

4. Listen for victim's exhalation.

5. If airway is partially obstructed, elevate mandible until inflation is free, without snoring.

6. Continue inflation at a rate of 12 to 20 per minute.

Obstruction of Airway. Safar⁵ states that not enough attention is given to the behavior of the airway above the larynx. According to this author, the incidence and degree of airway obstruction is influenced by the shape of lips, teeth, mandible and tongue, body type, and depth of anesthesia or coma. The pharynx of obese subjects seems to become more readily obstructed. Airway obstruction is not influenced by position — prone or supine — of subjects. The author further states that the pharynx of comatose victims becomes obstructed when the head is flexed in either of these positions, with or without use of an oropharyngeal airway. Extension of the head at the atlanto-occipital joint (sniffing position) is of utmost importance. This opens the pharynx in one-half to two-thirds of the

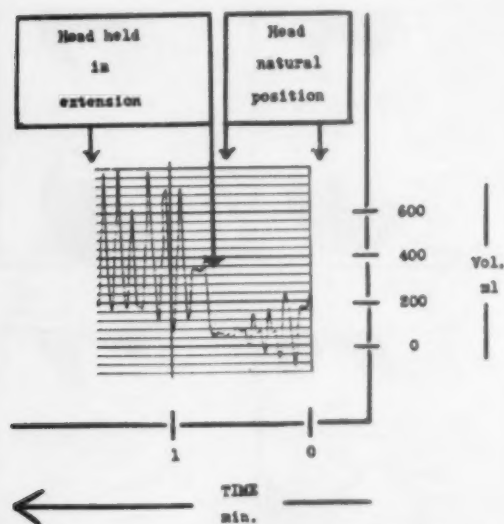


Fig. 3—Tracing from right to left showing increased ventilatory volumes when head is held in extended position, thereby eliminating the airway obstruction when head is in a natural (flexed) position.⁵

subjects. The remaining subjects require, in addition, the insertion of an oropharyngeal airway and forward displacement of the mandible. (See fig. 3.)

Technics for Measuring Tidal Volumes and Oxygen and Carbon Dioxide Concentrations. Gordon³ measured tidal volumes of infants on a recording spirometer. The various technics of manual and mouth-to-mouth resuscitation were performed both with and without endotracheal tubes. In five cases endotracheal tubes were inserted into the airway and connected to the spirometer. Measurements were continuous during performance of manual methods. For mouth-to-mouth resuscitation, the endotracheal tube was clamped and connected to the spirometer after the rescuer breathed into the airway. The expiratory tidal volume then was measured.

The endotracheal tube was not used in nine cases. Instead, a rubber mouth-piece (resembling a basal metabolism type of apparatus) was inserted between the lips and held in place by adhesive tape. A nose clamp was placed on the nostrils. This procedure allowed the jaw and tongue to be unrestrained and assume a natural position, allowing partial or complete airway obstruction. The

mouth-piece was then connected to the spirometer for continuous recording during the manual methods. During mouth-to-mouth resuscitation, a short extension from the mouth-piece was clamped after the rescuer breathed into the airway. The extension was then connected to a spirometer, and the expiratory tidal volume was measured when the clamp was removed. Various methods, except the mouth-to-mouth and back-pressure arm-lift methods, were also studied with and without "continuous digital airway."⁶ To accomplish this, a small slit was made in the rubber mouth-pieces for insertion of the operator's middle or index finger.

Elam⁴ studied oxygenation of subjects during expired-air resuscitation in several ways, often simultaneously. Air was continuously sampled at the airway of the subject by a mass spectrometer to obtain a record of alveolar and inspired oxygen concentrations of both subject and rescuer. Van Slyke's analyses of oxygen content and oxygen capacity of arterial blood were determined before and during resuscitation. In addition, arterial blood was analyzed for carbon dioxide content, carbon dioxide tension, and pH. In-

⁶Rescuer's finger in victim's mouth to keep airway clear.

Table 1: Pulmonary Ventilation During Artificial Respiration on Nine Asphyxiated Infants

No. Case	Infant		Sleeping Tidal Volume	Mouth-to-Mouth	Tidal Volume with Mouthpiece and Noseclip, Cc./Respiratory Cycle*		Back-Pressure Arm-Lift		Back-Pressure Hip-Lift		Manual Rocking	
	Mo. Age	Weight Kg. (Lb.)			Silvester (A)	Back-Pressure (B)					Prone 45°-45°†	Supine 45°-45°†
1	5	6.8 (15)	32	86	16	0	0	26	0	0	0	0
2	12	10 (22)	48	140	58	40	81	131	106	10	6	6
3	17	11.3 (25)	56	122	19	0	0	38	0	0	0	0
4	18	10.4 (23)	58	148	58	38	44	88	72	0	0	0
5	24	14 (31)	62	194	40	80	22	81	40	0	0	0
6	28	14.5 (32)	70	184	66	0	0	87	0	0	0	0
7	30	13.6 (30)	87	196	25	0	0	140	88	26	0	0
8	32	16.3 (36)	88	220	16	0	0	47	0	13	20	20
9	36	17.2 (38)	94	260	62	78	16	87	50	25	22	22

*In each series, (A)=results obtained when method was performed with operator's finger in mouth to keep airway clear. (B)=results obtained without operator's finger in airway. Since back-pressure arm-lift requires operator to use both hands, all measurements were made without operator's finger in airway.

†Indicates rocking from 45 degrees head-down position to 45 degrees feet-down position.

spired and alveolar carbon dioxide concentrations of subject and rescuer were recorded by sampling at the airway with a Liston-Becker analyzer. Tidal volumes were obtained when a calibrated pneumotachograph record of airflow before and during resuscitation was integrated. Records of rate, pressure, and volume of inflation also were made when rescuers ventilated a "mechanical dummy" simulating extreme bronchoconstriction and spastic rigidity of a chest in tonic contraction.

These authors also studied the feasibility of expired-air resuscitation during transport of the victim. The rescuers exercised as they ventilated a model simulating bronchoconstricted victims. The experiments were then repeated with the addition of a 300 cc. dead air space imposed on the rescuer. Under these conditions for the rescuer, alveolar concentrations were measured by a Rahn end-expiratory sampler with a Cambridge hot-wire carbon dioxide meter and a Beckman oxygen analyzer. Expired air was collected in a spirometer for oxygen and carbon dioxide concentration determinations.

Safar⁵ recorded tidal volumes and respiratory rates from a volumetrically calibrated pneumograph placed over the victim's chest and upper abdomen and connected to a tambour inkwriter. During the chest-pressure arm-lift methods,

measurements were made by connecting a tight fitting face mask to a recording spirometer. This arrangement did not interfere with the natural position of the subject's head. In a number of experiments an ear oximeter was used to record the relative arterial oxygen saturation of hemoglobin. Carbon dioxide concentrations of end-expiratory air were determined from an infrared carbon dioxide analyzer. Lung-chest distensibility of all subjects and the amount of air forced into the stomach by mouth-to-mouth methods were measured at intervals. In addition, it was possible to obtain an objective analysis when several rescuers each performed a variety of mouth-to-mouth techniques.

Results

Results of ventilatory studies with infants and children by Gordon³ are shown in table 1. The mouth-to-mouth method of resuscitation resulted in significantly greater ventilation than all other methods. In their work with adult subjects, it was found that the push-pull and mouth-to-mouth methods of resuscitation provided ventilation of about twice the resting tidal volumes when an endotracheal tube was used. (See table 2.) However, when the mouth-piece and nose-clip were substituted for the endotracheal tube, only mouth-to-mouth in-

Table 2: Mean Pulmonary Ventilation During Artificial Respiration on Eight Apneic Normal Adult Male Subjects

Method	Cuffed Endotracheal Tube, Cc./Respiratory Cycle	Mouthpiece & Noseclip	
		Cc./Respiratory Cycle	Per Cent Cases Actually Ventilated
Normal resting tidal volume	540	...	...
Mouth-to-mouth	1,020	910	100
Silvester	920	450	50
Back-Pressure arm lift	950	580	62.5
Back-Pressure hip-lift	1,090	650	75

Table 3: Patient's Arterial Blood and Alveolar Gas Values Before and During Expired-Air Resuscitation

	Before Resuscitation			During Resuscitation		
	No. Subjects	Mean	Range	No. Subjects	Mean	Range
Alveolar gas oxygen, %	6	12.8	9-15	6	16.1	15-17
Change in alveolar gas oxygen, % .....	..	..	..	6	3.8	1-7
Arterial blood oxygen saturation, %	14	92.4	84-96	25	93.7	87-100
Alveolar gas carbon dioxide, %	12	5.6*	4.3-6.9	12	3.9	2.7-5.1
Change in alveolar gas carbon dioxide, % .....	..	..	..	16	-1.0	-0.2--2.3
Arterial blood carbon dioxide tension, mm. Hg.	14	31.6†	26-35	17	26.6	18-37
Arterial blood, pH	14	7.48	7.45-7.53	14	7.54	7.43-7.65

*Recorded with Liston-Becker analyzer after anesthesia had been induced.

†Arterial samples obtained prior to anesthesia.

Table 4: Speed of Reoxygenation and Reversal of Carbon Dioxide Accumulation During Expired-Air Resuscitation

	Number Subjects	Seconds Mean	Seconds Range
Return of arterial oxygen saturation to control value (oximeter)	13	67	15-200
Return of alveolar oxygen to control concentration	6	12	5-20
Return of alveolar carbon dioxide to control concentration	16	19	3-120

Table 5: Effect of Exercise by Rescuer During Simulated Resuscitation

Conditions of Simulated Resuscitation	Oxygen Consumption, Cc./Min.	Tidal Volume, Liters	Expired Oxygen, %	Expired Carbon Dioxide, %	Minute Volume, Liters	Energy Cost, Cal./Min.*
Before resuscitation	273	0.74	16.68	3.59	7.4	1.32
Exercise during resuscitation†	871	1.56	15.96	4.49	20.4	4.21
Exercise while ventilating "bronchoconstricted" model‡	1,358	2.75	15.96	4.83	27.9	6.68

*Calculated at 4.8 calories per liter of oxygen.

†280 Kg.-meters per minute, equivalent to climbing 60 flights of stairs per hour.

‡Resistance: 20 cm. of water per liter per second at 1 liter per second flow.

sufflation ventilated the subjects adequately. Manual methods did not ventilate 25 to 50 per cent of the subjects. Moreover, a 40 to 50 per cent reduction in ventilatory volumes was observed in those subjects who were ventilated at all by these methods.

The findings of Elam⁴ in regard to alveolar oxygen concentrations, arterial oxygen saturation, carbon dioxide exchange, and arterial carbon dioxide and pH changes with expired-air resuscitation are summarized in table 3. An analysis of the speed with which these authors were able to reoxygenate 13 subjects with this method of resuscitation is given in table 4.

As shown in table 3, the mean alveolar oxygen concentration of six patients increased from 12.3 per cent before resuscitation to 16.1 per cent during resuscitation, and the alveolar oxygen concentration was elevated above the control in every instance. The mean arterial oxygen saturation during resuscitation was 93.7 per cent. In 14 subjects, arterial oxygen saturations were determined before anesthesia and during resuscitation, and no statistically significant difference in oxygen concentration was found in determinations obtained from 5 to 65 minutes after start of resuscitation. In 12 subjects tested, the mean alveolar carbon dioxide concentrations were reduced from 5.6 per cent before resuscitation to 3.9 per cent after resuscitation. The mean arterial carbon dioxide tension of 17 subjects was 26.6 mm. Hg during resuscitation. No untoward effects of this mild hypocapnia were noted. The arterial pH of 14 persons was determined before and during resuscitation. With emphasis on hyperventilation, mean values were elevated from a pH of 7.48

before resuscitation to 7.54 after resuscitation—confirming that expired-air resuscitation can effect carbon dioxide elimination beyond marginal requirements.

When untrained "rescuers" ventilated a bronchoconstricted model for one-half hour in studies by Elam,⁴ the average inflation was 741 cc. (range 406 to 1,160 cc.) and average rates were 10 per minute. None of the rescuers experienced significant chest fatigue. It was found that the rescuers maintained normal expired oxygen and carbon dioxide concentrations while exercising. Oxygen and energy consumption of the rescuers under these conditions are given in table 5.

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Effect on Coronary Circulation of Cold Packs to Hemiplegic Shoulders

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● The evaluation is presented of the possible effect on coronary circulation of the use of cold packs to hemiplegic shoulders. In 20 subjects without heart disease no significant electrocardiographic or clinical changes were noted. In 25 subjects with known coronary artery disease (including 15 subjects with left hemiplegia) one patient with left hemiplegia showed significant RS-T segment depression with T wave inversion. It is not expected that the relatively minor skin and intramuscular temperature changes will cause significant reflex vasoconstriction of the coronary arteries, or other hemodynamic changes, but it apparently can occur and must be considered a possibility if such therapy is undertaken. Experience with cold packs in hemiplegia, noted in this study, shows that patients reported reduction of pain and better tolerance for stretching temporarily; in some instances pain diminished or disappeared after seven to 12 daily cold applications.

We have used cold packs to relieve muscular pains, spasm and spasticity at times when we felt it unsuitable to use heat for this purpose.

We have done this because of certain reports on the effect of cold in the reduction of spasticity,¹ the effects of ethyl chloride spray on trigger points and fibromyositis²⁻⁴ and the observation of the use of cold packs at another institution. On reviewing the literature, we found very few studies on the results of cold for the reduction of spasticity or pain, except in the case of ethyl chloride spray; cold packs were referred to casually and without sufficient data to formulate opinions.

The question of differential diagnosis with the anginal syndrome was raised because we had used cold packs for reduction of pain and spasticity in hemiplegic shoulders to regain passive range of motion in patients with known coronary artery disease and left hemiplegia. In simple cases this would not appear to be a problem, but at times the differentiation can be difficult. Cold applications—under certain circumstances such as the Cold Pressor Test⁵—cause abrupt elevation of systolic and diastolic pressures, tachycardia, vasoconstriction of distant peripheral arterioles, reflex changes in gastrointestinal activity⁶ and hypersensitivity to cold with transitory fall in blood pressure and syncope as

noted by Horton. The possibility, therefore, of myocardial ischemia, due to reflex coronary vasoconstriction through the parasympathetics or through changes in peripheral blood pressure, was considered as a potential source of complication to this form of treatment. The question was raised further as to whether cold packs to the shoulder were contraindicated in the presence of coronary artery disease, particularly where there was difficulty in differentiating the role of myocardial ischemia in producing referred pain or trigger points in the painful shoulder syndrome of the hemiplegic.^{7,8}

The shoulder/hand syndrome has been described following myocardial infarction and in the presence of long standing coronary insufficiency.^{9, 10} The shoulder/hand syndrome may be present in many patients with left hemiplegia as well as coronary artery disease. It may be difficult to determine whether the reflex sympathetic dystrophy is due to the central nervous system damage, to myocardial ischemia or to local factors. We have seen patients in which we felt all these factors aggravated the symptomatology of the painful shoulder syndrome. Reports of the use of cold in the shoulder/hand syndrome of myocardial infarction have not been noted. Part of our study is based on seeing whether cold does decrease coronary flow, a possibility which might lead to studying the effect of cold in the post-infarction shoulder syndrome uncomplicated by hemiplegia. We therefore decided to study the effect of cold packs on coronary cir-

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culatation, evidenced by the development of the angnal syndrome or electrocardiographic evidence of diminished coronary blood flow during and immediately after the application of cold packs. We also wanted to note changes in blood pressure, cardiac rate and skin temperature changes at distal points. Since we were carrying out the procedures, we felt it also would be desirable to see whether there was any objective correlation of reduction of pain and spasticity, with increased passive range of motion. We wanted to observe, as well, the patient's subjective reactions.

Cold Effect

Extensive studies by Wise,¹¹ Sheard,¹² Zaimis,¹³ Hollander,¹⁴ Wakim,¹⁵ and Bierman,¹⁶ on tissue temperature have been made.

It is clear from these studies that ice packs left in place for 15 minutes can decrease skin temperature 20-40 F.; less marked changes in the subcutaneous tissue and decrease in muscle temperature of 13 to 31 F. occur when the pack is left in place one to two hours. Ethyl chloride spray for 15 minutes can decrease skin temperature to the same degree but intramuscular temperatures only fall 7 F.

Method

Our observations were carried out on the following groups:

1. Ten normal patients.
2. Ten patients with known episodes of myocardial infarction without hemiplegia.
3. Ten patients with left hemiplegia but no history or electrocardiographic evidence of coronary artery disease.
4. Fifteen patients with left hemiplegia and a history and electrocardiographic evidence of myocardial infarction.

The hemiplegic patients were examined before the cold application. Diagnosis of the shoulder syndrome was made, plus a determination of the degree of pain, the limitation of range of motion, the point in range where pain started or movement was limited, the degree of spasticity and reflex hyperactivity, the local tenderness and the trigger points.

The patients routinely were picked because of left hemiplegia and the presence or absence of coronary artery disease. Criterion used was the history, with electrocardiographic evidence of myocardial infarction, and not the mere presence of shoulder disability. As a result, many of the cases were asymptomatic, with adequate passive range of motion; therefore, they were not liable to show dramatic changes as a result of the cold applications.

Before application, and again immediately after removal of the cold packs, and in some instances during the application of the fifth pack, 12 lead electrocardiograms were taken to detect myocardial ischemia. Criteria for comparison of cardiographic evidence of myocardial ischemia were those revised by Masters in his Step Test: depression of RS-T segment greater than .5 mm. involving the entire segment not merely the junction of RS-T segment.¹⁷

Cold packs were prepared by soaking ordinary toweling in ice water tubs filled with ice cubes; the water temperature was approximately 32 F. After the towels had soaked in the water for five minutes or more, a towel was placed over the patient's shoulder, stretching from the base of the neck to the elbow and anteriorly and posteriorly along the border of the deltoid muscles. Five packs were used, each for two minutes before being changed. Skin temperatures, subcutaneous temperatures and intramuscular temperatures were taken, just below the acromion process over the mass of the deltoid muscle, before and after the packs were removed. The temperatures were recorded by a thermocouple adjusted to room temperature. The readings were made in a closed room where no attempt was made at constant temperature control. Our temperature recordings were not to be taken as completely accurate but only as a check to see that they followed the general gradients which would be expected and which have been reported previously.^{11, 15, 16}

Results

1. In all subjects, skin temperature dropped 10 to 29 F., with an average of

20 F.; subcutaneous temperature dropped an average of 6 F.; intramuscular temperature an average of 3 F. These changes followed the gradients noted by Wise, Wakim and Bierman.

2. Initially the skin temperature of the involved shoulder was generally lower than the uninvolved side. Skin temperature of hands varied and were unpredictable, but were lower than shoulder temperature in our cases of shoulder/hand syndrome.

3. Skin temperatures varied as much as 5 degrees in the subacromial region, indicating marked variation in skin temperature as well as a non-uniform cooling pattern due to uneven placement of packs and prominences.

4. Skin temperatures usually reached the low level after application of the second pack. After this level was reached, skin temperature would be at low at the beginning of new packs and would rise 2 degrees to 4 degrees at the end of the two minute application as the pack warmed.

5. Oral temperatures did not change.

6. In some patients with application of packs there was a decrease of 1 to 2 degrees in skin temperature at the opposite shoulder, the thumbs and the toes. There was no change in blood pressure in these instances.

7. No subjects manifested increase in blood pressure above 10 mm. Hg systolic or diastolic although one patient with hypertension decreased 20 mm. Hg systolic and 10 mm. Hg diastolic. The hypertensive patients and the normal subjects who manifested increases with the packs when given the Cold Pressor Test had elevations of 30 mm. Hg systolic and 20 mm. Hg diastolic. This indicates that the cold pack does not have the same intensity of effect.

8. Increase of pulse rates above 10 per minute was rare; the maximum was 20 per minute in one case. No arrhythmia was produced.

9. Patients' painful shoulder syndromes were classified according to severity:

A. No problem category (eight cases) — no pain at rest; 135 degrees of flexion abduction; may have pain at extreme of motion range.

B. Mild category (three cases) — may have rest pain; pain at extreme of motion range; 100 degrees abduction and 45 degrees external rotation.

C. Moderate category (eight cases) — pain at rest; greater limitation of range of motion with considerable pain at the extreme of motion range.

D. Severe category (six cases) — considerable rest pain; 50 degrees abduction and 20 degrees external rotation; definite distress pain on motion; hand may have edema, pain and limitation in range of motion.

Six out of the eight patients in the moderate category showed the most striking improvement in range of motion and relief from pain.

10. The eight patients in the no-problem category and the three in the mild category showed the expected minimal responses. Two of the six patients in the severe category improved slightly. These observations refer to the period immediately after the application of individual packs.

11. Electrocardiography showed no significant changes following cold packs in Groups 1 and 3 (those subjects who had no known coronary artery disease). No changes were noted in Group 2 (those patients who had coronary artery disease without hemiplegia). In Group 4 (those patients with left hemiplegia and coronary artery disease) one patient showed significant depression of the RS-T segment with inversion of T in lead V4 immediately after the application of the cold pack but did not show clinical evidence of anginal syndrome. This one case, out of 25 with known coronary artery disease, reflected transient evidence of myocardial ischemia. This patient did not have hypertension and manifested no change in blood pressure or cardiac rhythm.

12. The patient's subjective reaction to cold packs was good. The majority said it was pleasant and more effective than other methods in reducing rest pain and pain at the extreme of range of motion, and, also, in increasing the pain-free range of motion. In cases with pain, improvement was noted for periods of one-half to four hours after treatment and the majority reported gradual de-

crease or disappearance of pain over periods of 7 to 12 days of treatment.

Comments

Depression of the RS-T segment greater than .5 mm. was the criterion used as the least likely to give false positives, as revised by Master for determining myocardial ischemia. Our one subject with a positive reaction was observed early in the study and so encouraged our further observations. In the absence of coronary artery disease we have no instance of change and there would appear to be no reason for caution under those circumstances. However, in the presence of known or indeed possible impairment of myocardial circulation, consideration must be given to the possibility of this effect. The number of our patients is small and with further study the incidence may come to be negligible. One also must consider whether such changes should necessarily contra-indicate the technic if the technic is effective in its primary purpose. If a significant percentage of larger studies shows these changes, particularly if lower tissue temperature for longer periods are found necessary for clinical results, one will have to be cautious in using this technic. We think that such changes in technic may be necessary for clinical improvement on the basis of the rather unremarkable changes noted in the course of this study. Because of the reports of the use of ethyl chloride spray in myocardial infarction, we are encouraged to be hopeful that no untoward effects on coronary circulation occur as a result of cold application. The numbers, however, of such cases presumably were not large and the acute circumstances might have obscured these transient changes. No significant complications have arisen during the use of ethyl chloride spray to the shoulder or chest in cases of myocardial infarction or anginal syndrome, reported elsewhere, although presumably much greater temperature drops are achieved. It is possible, of course, that RS-T segment changes occur but without clinical effect immediately or subsequently.

Despite the studies of the temperature changes following local application of cold packs few reports tell this technic's effect in the reduction of pain, spasm and spasticity. Such reference as exists appears primarily concerned with spasticity, which is difficult to evaluate and which commonly fluctuates both spontaneously and temporarily with the use of a variety of procedures. However, cold application by ethyl chloride spray has been extensively studied and found effective in the reduction of pain and of painful muscle spasms. Travell² points out the importance of shoulder trigger points with referred pain. She reports that an acute process in an internal organ may give rise to secondary myofascial areas which become pain sources, independent of the original source of pain impulses. An example is myocardial infarction which gives rise to independent trigger points in the chest wall. Gammon and Starr¹⁸ found that intermittent cold was the most effective of the counter-irritants which they tested; the intermittent cold use was more effective than continuous cold. They also found that the intensity of cold had to be close to that which produced pain itself, thus causing the counter-irritant effect. Counter-irritants work through neurogenic stimuli mediated through the central nervous system and the effect does not appear to be due to reflex changes in the blood flow. Travell came to the conclusion that the action of ethyl chloride is that of a counter-irritant.

In a previous paper^{19, 20} we have outlined causes of the painful shoulder syndrome; any one or more may be a factor in the hemiplegic shoulder. We feel that not all pain or restriction of range of motion in the hemiplegic shoulder are due to the same cause; that careful analysis will indicate that there are various specific mechanisms which may be predominant in the individual case.

Possible Factors

Factors may be:

1. Intra-articular or periarticular disease including bicipital tendonitis, degenerative cuff disease and/or acute bursitis.

2. Postural factors secondary to paralysis of the shoulder girdle with strain on the joint capsule.

3. Some studies say that the strain of the dependent arm may stretch and cause irritation of the fifth cervical nerve with pain in its distribution over the point of the shoulder.

4. Reflex sympathetic dystrophy manifested by the shoulder/hand syndrome.

5. Pain syndrome secondary to the thalamic syndrome with central pain and secondary guarding.

6. Severe spasticity may be increased in the presence of the other factors mentioned when they are painful, or severe spasticity may be present independently, giving rise to secondary myositis and trigger points with referred pain.

7. The scapulocostal syndrome may occur as a result of the abnormal position of the scapula secondary to paralysis.

8. Pain in the shoulder may be secondary to coronary insufficiency, either as referred visceral pain or as muscular trigger points secondary to myocardial ischemia.

In general, the primary factors present in the hemiplegic shoulder of immobility, secondary to paralysis and/or spasticity, may initiate the symptoms or may aggravate the symptoms if caused by one of the other mechanisms. Occasionally shortening of the long adductor muscles causes painful fibromyositis but this painful condition is more common in the muscles of the rotator cuff mechanism. Many patients with a painful shoulder have anxiety reactions which contribute to muscle guarding and a heightened awareness of pain.

Summary and Conclusions

The use of cold packs to hemiplegic shoulders has been studied to evaluate the possible effect on coronary circulation findings included:

(a) In 20 subjects without heart disease no significant electrocardiographic or clinical changes were noted.

(b) In 25 subjects with known coronary artery disease (including 15 left hemiplegias) one patient with left hemiplegia showed significant RS-T segment depression with T wave inversion.

(c) While we do not expect the relatively minor skin and intramuscular temperature changes to give rise to significant reflex vasoconstriction of the coronary arteries, or other hemodynamic changes, it apparently can occur and must be considered a possibility if such therapy is undertaken. It is perhaps true that such RS-T changes may not reflect significantly harmful changes in coronary circulation.

(d) The use of an ice pack, or of more convenient apparatus for local controlled application of cold, makes it possible to achieve lower skin and intramuscular temperatures; perhaps this increases the risk of producing myocardial ischemia in the presence of coronary artery disease.

(e) Our experience with cold packs in hemiplegia indicates that patients noted reduction of pain and better tolerance for stretching temporarily; in some instances pain diminished or disappeared after 7 to 12 daily cold applications.

(f) The technic of manual application of cold pack is cumbersome and requires the constant attention and exertion of the physical therapist. If cold in repeated applications relieves pain, reduces the inflammation in the soft tissues, and diminishes spasticity significantly, we believe a less demanding technic of application would be desirable.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



COURSE IN REHABILITATION CARE OF THE CHRONICALLY ILL PATIENT

The Department of Physical Medicine and Rehabilitation at New York Medical College, Metropolitan Hospital Center is scheduling a one-week course for physicians, devoted to the rehabilitation care of the chronically ill patient, November 14-18, 1960. The course will offer a review of the principles and technics in the medical care of the chronically ill to meet the needs of the clinician, medical administrator and public health physician. Course content will include: Physiology and Pathology of Chronic Diseases, Nutrition and Dental Care, Management of Bedridden and Incontinent Patients, Home Care Programming, Community Needs and Resources, Public Health Aspects, Self-Care Activities, Prosthetic Devices, and Psychological and Social Aspects. The tuition fee is \$150.00. Traineeships for tuition, maintenance and travel are available through funds provided by the U. S. Office of Vocational Rehabilitation. Applications for the course and traineeships can be obtained directly from Jerome S. Tobis, M.D., Chairman, Department of Physical Medicine and Rehabilitation, New York Medical College, 1 East 105th Street, New York 29, New York.

Motivation in Rehabilitation of the Physically Handicapped

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● In a previous paper, a conception was developed relating personality traits, performance and stress. In this study the authors elaborate the implications of this conception for the problem of motivation—universally regarded as of prime importance to a patient's success in his rehabilitation program. We are concerned with the question of how the motivation of rehabilitation problem cases is changed during treatment from "poor" to "good." Generally the term "poor motivation" is applied to: 1. Patients who refuse to try the prescribed task; 2. Patients who try but give up quickly; 3. Patients who keep trying but fail to learn. Cases of each category are presented in which motivation was changed from "poor" to "good." Motivation is seen as a complex of forces—some interfering with and some disposing towards effort and learning. Thus, negative and positive motivational factors exist. Negative motivational factors arise in states of increasing stress while positive motivational forces develop with decreasing stress. Clinically, increasing stress develops as the patient is unable or anticipates being unable to achieve what he is trying to do. Decreasing stress ensues as the patient becomes able or anticipates being able to achieve his goal. Rehabilitation therapy strengthens and develops positive motivational factors and weakens and eliminates negative ones by affecting the patient's goals and actions so as to improve his ability to achieve what he is trying to do.

Motivation is commonly regarded as of prime importance in the field of rehabilitation. When a patient does not respond to rehabilitation efforts, "poor motivation" is often considered the underlying cause. Motivation frequently is related to emotional conflicts^{1,2} or is considered "an internal and very personal matter."³ The assumption implied in this attitude is that motivation is solely the patient's internal problem and is not subject to therapeutic influence. The psychiatrist and the psychologist then are called upon to free the patient with some of their magic from the diabolic effects of this mysterious attitude. Usually such problems are never satisfactorily resolved and these disturbing cases are considered failures in rehabilitation, attributable to poor patient motivation.

In practice, motivation is measured in terms of patient performance. Motivation may be defined as the patient's ability to engage in, work at and learn a prescribed task. Generally, we infer "good" or "poor" motivation depending upon the patient's success or failure in the rehabilitation program.

The authors assume that therapeutic efforts affect the patient's motivation as

well as his performance. If valid, this concept would make problems of motivation, as defined here, a matter of more direct concern to the psychiatrist.

This presentation explores some of the factors that influence the patient's performance, such as his personality traits,⁴ his neuropathologic disturbances and the behavior of the therapist. Through the use of case material, an attempt will be made to show that the patient's motivation varies with changes in performance as affected by therapeutic intervention.

Nine Cases

Nine cases are presented in which motivation was "poor" at some time during the rehabilitation program but underwent changes during treatment. These cases fall into three main groupings:

- A. Those who were reluctant or refused to try the prescribed task.
- B. Those who tried and did poorly.
- C. Those who did well at first and then regressed.

Group A

Cases 1 and 2, particularly, typify the successes of most rehabilitation programs. We have selected them because they illustrate that rehabilitation, as it now exists, often changes motivation from "poor" to "good".

Case 1. A 38-year-old male, with post traumatic paraplegia (Level T-11) of recent origin, was confined to a Stryker frame because of decubiti. The patient was becoming progressively more of a

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ward problem. He kept to himself and rarely talked to other patients. He was subject to temper outbursts which antagonized the nursing and attendant staff who preferred to have as little to do with him as possible.

For two months the patient repeatedly refused invitations to attend ward recreation parties held elsewhere in the building. Rather than antagonize him this aspect of his rehabilitation program was dropped without a struggle. A social worker (B.F.) then adopted a new approach after consultation. She told the patient she definitely wanted him to try to go to the next ward party. She said she would wheel him there and if he then wanted to leave she would take him back to his ward. Although he shook his head and said, "No," he readily permitted himself to be taken to the party. Once there he slowly got involved in the singing, the eating and the other activities and stayed without any protest for the one and a half hours that the recreation continued.

Comment: Refusal to go to a prescribed activity was altered positively by introducing conditions which permitted the patient to get involved in actual satisfying experiences. We may assume that these experiences at the party generated a readiness to get further involved. In any case the patient's motivation to participate in the recreation program was changed from negative to positive by therapeutic intervention that brought about successful participation. Earlier, our failure to challenge his strongly negative attitude to the program had only made matters worse. The negative response of the attendant and nursing staff to his personality had also contributed to the learning block and the poor motivation.

Case 2. A 40-year-old housewife and mother was left with a paraplegia as the result of poliomyelitis contracted five years earlier. Following a very limited rehabilitation program in the hospital she was sent home with braces, Canadian crutches and a wheelchair. In walking at home she was never able to relinquish the arm of her husband and to rely on the crutches alone. She said, "I am so

afraid I start to shake. I think of all the things that could go wrong, particularly losing my balance and falling." She became helpless and depressed about her ability to ever do more than she was then doing. She volunteered that her fear of falling exceeded her concern about getting hurt but she could not control her reactions. She refused to try walking with the crutches alone, even when held by her husband.

After psychiatric and physiatric consultation a trained therapist was sent to her home to help her learn to walk. With the physiatrist mapping out the general program, the therapist developing specific aspects of the program and the psychiatrist discussing the effects of her experience and preparing her for future difficulties, the patient soon began to make rapid progress. Within six weeks she was using the crutches to walk up steps. The patient became an enthusiastic and capable participant in a progressively advancing program.

Comment: A sense of hopelessness, a reluctance to try and a lack of progress characterized her efforts at home for five years. When the proper therapeutic conditions were introduced she tried as directed. Each little success seemed to generate more effort and more achievements. Soon she began expressing feelings of hope and eventually enjoyed working at her strenuous program. "Poor" motivation became "good" as appropriate therapeutic intervention helped her get involved and then to learn successfully.

Case 3. Current symptoms of a 45-year-old woman, who had had Parkinsonism of unknown etiology for 11 years, were slight to moderate, bilateral, "pill-rolling" tremors, moderate rigidity of her arms and trunk and occasional festinating gait. The patient declared that she felt helpless about ever getting better and anticipated a progressive and relentless deterioration in her condition. When she observed herself shaking or functioning worse than she anticipated she experienced marked palpitation, nervousness and panic. Her automatic reaction to such stress was to avoid functions which produced these dreaded symptoms and

behavior. For example, six years ago she had stopped cutting meat served to her in public and three years ago had given up this function at home. She said, "I just can't do it; my hands are too weak." When she was directed to show the examiner how she cut her food in her plate she sawed away with her knife with a few strokes. She then stopped and said, "See, I don't have the power, it's no use." She was then asked to press down on the examiner's fingers using the back of her knife and to use a cutting motion as she did when she tried to cut the meat. The examiner then told her, as she pressed harder and harder, when he felt she was pressing hard enough to cut meat. At home she began to focus on and study the process of cutting which she had completely given up as a lost cause. Within a week she happily announced that she had learned to cut meat for herself. She felt much more encouraged to struggle with her disease and began to show progress in the areas of walking, sitting, appearing in public and in eating activities.

Comment: This progressive neurologic disease seemed to have fostered in this personality a growing sense of hopelessness, a powerful automatic disinclination to engage in areas of deficient performance and an unnecessary loss of function after function. Proper therapeutic conditions opposed her trait of avoiding the problem areas and helped her to get involved in learning how to utilize her still intact neuromuscular apparatus more efficiently. As she performed better she became more ready to try and to look into and study areas of difficulty. Creation of conditions for improved performance generated better motivation.

Group B

Case 4 is an example of how neuropathology can operate to disrupt performance and generate "poor motivation."

Case 4. A 72-year-old man had a left spastic hemiplegia and a mild ataxia on effort, weakness and hyper-reflexia on the right side. He made little effort to feed himself and demanded loudly that others do it for him. He was regarded

as "poorly motivated." Some of the staff ascribed his poor work to the fact that his wife had just become hopelessly ill. But many of the attendants and nurses resented his referring to them as his servants and began to demand that he feed himself. When he tried, he often broke down and cried with frustration. His ataxia and weakness only seemed to get worse with effort. He began to refuse to eat unless others fed him. He was losing weight. Detailed observations were then made of the patient's eating problems in the dining room. When he tried to feed himself he did very poorly even when using special gadgets. Analysis of the problem revealed the following unusual information. First, when he felt he was putting the food into his mouth the spoon actually reached a point beneath his chin. Secondly, when he felt the food was in his spoon as he tried to pick it up he saw that it was to the right of the spoon. These facts frustrated and disturbed him deeply. He had told no one about them assuming that something had gone wrong with his mind. His performance seemed to get worse when he got upset and he then felt like giving up the whole effort. When he was asked to touch his nose with his eyes closed his index finger went off to the left. With his eyes opened he performed this same procedure satisfactorily. The patient was told that these discrepancies between his performance and his expectations were probably related to the stroke and that if he kept practicing he would eventually be able to feel and see in an integrated fashion. After two or three more practice sessions the patient was able to put food in his mouth properly and to get the meat in the spoon with much less difficulty. The discrepancy between his feelings and his performance began to get less and less. He felt much encouraged and soon was able to feed himself from his plate.

Comment: The brain damage apparently had adversely affected neuronal connections bearing kinesthetic and proprioceptive information while the pathways conducting visual information were undamaged. Perception and control of muscles based on interoceptive informa-

tion, therefore, were inaccurate while visually determined functions were intact. The unexplained discrepancies between performance based upon interoceptive and exteroceptive information confused, frightened, angered and frustrated the patient. Each effort became more and more stressful and less and less successful. He became more and more reluctant to even try. When new therapeutic conditions, based upon recognition and understanding of his perceptual problems, were introduced the patient made progress and he participated much more enthusiastically and effectively. His motivation had improved.

Case 5. A 50-year-old woman, with left hemiparesis, did very well in her ambulatory program until she was asked to stand up and walk from the chair with the therapist holding and supporting her from behind. She tried again and again to do as requested, but each time her feet seemed to shuffle backwards towards the chair instead of away from it. She shook grossly, felt very upset and was very unhappy. Most of the staff felt that she was "poorly" motivated and a psychiatric consultation was requested.

During the examination it was observed that when she tried to walk unaided in the narrow space between her bed and the partition of her ward cubicle she was successful when she faced the head of the bed but became terribly unsteady and could not move when she turned and faced the foot of the bed and the open corridor. Then the patient suggested that if one of the examiners would stand in front of her and extend his hand so that she could grasp it she thought she would be able to walk. Surprisingly, she did as she predicted, holding on ever so lightly to the proffered hand as she walked. In response to a question she said that she had never liked to depend on other people. Furthermore, she felt more secure with the doctor before her with one finger held out to her than when she faced the open room even if he stood behind and held her firmly. This bit of progress in walking was soon followed by other advances in her program and she lost the stigma of being "poorly motivated."

Comment: The severe distress the patient experienced as she faced the open space in the corridor and in her cubicle greatly interfered with her ability to walk as desired. Being firmly held by the therapist from the side or from behind failed to lessen her distress. Apparently she was much more adversely affected by her reaction to the open space than she was helped by the physical support of the therapist. With the therapist before her the space that she had to negotiate was reduced and she felt less disturbed. In the new position, also, she felt self-reliant and this contributed to her sense of stability. By stopping and analyzing the conditions under which the patient performed well and poorly and inquiring about her feelings and thoughts, in the process, the proper therapeutic conditions could be introduced. The effective functioning that ensued was followed by increasing ability to try and to learn successfully. Again better performance led to improved motivation.

Case 6. A 64-year-old diabetic, with a left mid-thigh amputation, was learning to walk with a pylon. He did very poorly for six months. The patient complained about being "done in" and held back in his progress by former employers who "were out to get me." He frequently assailed the staff for being against him and for preferring other patients. Since he lived alone and apart from his family, he was suspected of not really wanting to get well and, therefore, of not trying hard enough. The therapists disliked the patient for his abusive behavior. Consultation and discussion helped the therapist see that the patient's paranoid reaction might be a reaction to the stress of his task and, more important, that the patient could not attend adequately to the task at hand when he was fully absorbed in complaining about others or was involved in conflict with the therapist. The patient then was firmly directed by the therapist towards the task despite his complaining and soon learned to perform better. He went on slowly to master the use of his artificial limb.

Comment: Here poor progress was related mainly to the interference created by the patient's paranoid reaction to

stress⁴ and by the therapists' negative response to his behavior. When the patient and the therapist were helped to get more involved in the task than in his accusations the patient was able to learn satisfactorily even though he remained almost as paranoid as ever. An understanding of how the personality trait and paranoid behavior interfered with learning, permitted the introduction of the correct therapeutic conditions. Improved performance was followed by better motivation.

Group C

Case 7. A 54-year-old man had both legs amputated below the knees. His first amputation had occurred 21 years before and he had successfully utilized his first artificial limb. One year ago, just before the second amputation occurred, the patient became severely depressed and attempted suicide. A diagnosis of psychoneurosis, reactive depression, was made. Soon after the amputation his spirits revived. When he began his rehabilitation program the patient was determined to learn rapidly and to get out of the hospital. He visualized himself progressing spectacularly in his program. Provided with a double prosthesis the patient did phenomenally for two weeks. He walked so well with canes that the physician in charge felt that two to four weeks of additional training might be sufficient for the patient to be discharged. One day the patient fell. He said, "for the first time in my life I felt afraid at the thought that I may fall again." When he attempted to walk he began to wobble, became panicky and visualized himself becoming a complete failure in the rehabilitation effort. His work began to slip badly and rapidly. He felt that everyone was disappointed with him and he began to brood about what had happened. He appeared depressed. He was told by his psychiatrist that his goals were too high but this meant nothing to him then and he showed no improvement for several months.

In a psychiatric interview after the depression began lifting, he reported that one day he was deeply moved by reading

a book which told of how a well-known war correspondent had endured terrible ordeals during his life. The patient reflected that his own lot was not so bad and that maybe his goals were too high as had been suggested months earlier. He took a new interest in his problem, examined his limbs very carefully and noticed some areas of pressure which he felt indicated some flaw in his prostheses. When the doctors agreed and had the limbs adjusted he felt more reassured and his stress began to decrease. But he was no longer as cocksure of himself as he previously had been. For the first time he began to be aware of the thousand and one new problems that have to be mastered in learning to walk with a double prosthesis; he saw that it was much more than twice what one would expect. His work then showed steady improvement and after a year he was discharged to the community walking unaided and able to drive a car.

Comment: The breakdown in performance here was linked both to unrealistically high goals held both by the patient and the staff and to his personality trait of becoming deeply depressed over the prospect of failure. The unexpected fall resulted in severe stress which not only disrupted his function but exploded his remarkably positive motivation. After months of suffering and of comparing himself with other less fortunate people in the ward and in books he was able to emerge, without formal psychotherapy, from the depths of depression, took some initiative again, began to make less extreme demands upon himself, felt less disturbed and did better.

Here improvement in motivation was linked to a slow, painful lowering of his goals to more realistic levels and a less severe attitude toward himself for his failure. Continued effort under the new conditions began to produce improved performance and dissipated his sense of hopelessness and worthlessness and restored the positive motivation.

Case 8. A 69-year-old woman, with left hemiplegia, had progressed satisfactorily in her ambulatory program up to the time she started to use a cane. She then fell without injuring herself but,

after the fall, she became more and more shaky. She felt handicapped by the fact that when she wanted to take a short step with her left leg and a long one with the right, as instructed, the opposite occurred. It seemed that the harder she tried the less her limbs behaved as she wished. She became very sensitive to the thought that the therapist was probably getting "fed up" with her. As her difficulty got worse she feared, inwardly, that "the therapist would eventually give up on me."

Each day she felt like asking to be allowed to go back to the parallel bars where she felt more secure but was afraid that the therapist would consider this a regression. She was very much afraid of antagonizing the therapist. As she kept at her efforts under these conditions she soon developed severe low back pain and had to be taken off the program. The therapist said that the patient "really did not want to get well" despite her overt efforts to learn. The therapist also expressed the opinion that as the patient entered the last lap of her program she unconsciously fought against getting well.

Comment: Although the patient had the handicap of the paradoxical movement of her limbs she performed satisfactorily until she began to use the cane. Then in the face of this more demanding task she experienced increasingly severe stress with marked feelings of anxiety and growing disorganization of her muscular control. After her fall she was less and less sure of herself and of her relationship to the therapist. She tried to follow the advice of the therapist but her limbs would not comply. Her anxiety increased and her ability to control her muscles declined. In this setting the severe back pain developed which eventually caused the patient to be removed from the program, just as she had predicted.

She began to live a wheelchair existence. The time and effort which would be required now to rehabilitate her exceeds what is available on a busy rehabilitation service with limited resources. It appears, in retrospect, that the relationship of the patient's fears and the paradoxical movement of her limbs,

which was probably linked to her brain damage, was not recognized and dealt with adequately in the rehabilitation situation so that her degree of stress got more and more severe. Her performance and "motivation" then declined precipitously.

Case 9. A 45-year-old woman had degenerative disease of the spinal cord, of unknown origin and of eight years' duration, involving all four extremities. Three years earlier the patient had gone to a rehabilitation center and exercises were prescribed for her to do at home. After one or more attempts to comply she stopped, saying, "I was too exhausted after work to do those stupid exercises."

Six months ago she was persuaded to try rehabilitation again and a therapist was sent to her home to carry out the prescribed treatment in the evenings. She rapidly succeeded in performing movements which she had felt were lost forever. She then began doing the exercises more and more regularly and made excellent progress. She became an eager participant in her program.

The patient then anticipated going away for the summer and wanted to be able to get into the water but felt that she would not be able to manage this alone. She asked the therapist to help her with this problem. To get the required practice the therapist accompanied her to a commercial indoor swimming pool. When the patient lay down on the water she was horrified and terror-stricken to learn that she could not control her right upper and lower extremities in the water. They sank down like dead weights and pulled her left side up. She absolutely refused to try again. She felt panicked and vividly visualized how she would inevitably end up with total deterioration of her body and have to be hospitalized while waiting for a slow but awful death. "The pool showed me how really damaged I am — so why bother? I'm just a useless cripple and hopeless."

This expression of hopelessness was followed by an abrupt cessation of her exercising at home. Her performance declined rapidly. The therapist began to urge her to do the exercises and then to threaten her with getting worse as she

continued to neglect the work. The more she was so treated the more she withdrew. Eventually she decided to stop the whole program and dismissed the therapist.

Comment: The patient's concept of her disease was a terrifying one. Her reaction to the stress of perceiving her illness was to avoid those functions where weakness or tremor made her disability manifest. She preferred to engage in functions where still intact muscles could do her bidding efficiently. Those muscles which were part of a defective movement fell into disuse. And when on occasion, out of external necessity, she tried to move them and found them nonresponsive she became panicky. Such failures combined with her anticipation of inevitable total failure seemed to have led to her negativistic attitudes and "poor motivation."

When she finally was helped to stick to the exercises under more favorable conditions improved performance was followed by the development of "good motivation." With hopes raised very high she attempted swimming and failed. She became so appalled and so disturbed that she again pulled away from the entire rehabilitation program. She now manifested "poor motivation."

In this case, unfortunately there was inadequate communication among the therapist, the physiatrist and the psychiatrist about the swimming episode and no further efforts were made at that time to construct a program to restore her confidence in her ability to function effectively. Her failure, while linked to her personality trait of giving up quickly when frustrated, also was ascribable to the failure of the therapeutic team to overcome the problem.

When she returns from her vacation we hope and expect again to be able to affect her so that she will become "positively motivated." She says of herself, "When I can't do something I get discouraged and give up."

Discussion

Motivation was poor or became poor in all of the cases presented when the patient performed worse or anticipated

doing worse than he expected of himself. Motivation improved when therapeutic conditions were introduced which permitted the patient to achieve his goal. Acceptance of the link between motivation and performance has an important influence upon how problems in rehabilitation are conceived and managed.

Current neurophysiologic concepts suggest a basis for understanding the relation between motivation and performance. When a person is continuously unable, for whatever reason, to achieve his goal, excessive stimulation of the reticular formation and overarousal of the cortex may be presumed to occur.^{5, 6} Disorganization ensues, experienced as severe mental and physical disturbance (e.g. severe stress and anxiety). Reactions automatically develop to avert further breakdown. Prominent among these defense reactions is the response of avoiding further involvement in the deeply threatening situation or of shifting to some other unrelated activity where effective behavior is immediately possible. Clinically, the patient's behavior then appears "poorly motivated." He cannot engage in the task situation or cannot stay in it long enough to learn effectively and progressively.

Successful management of such cases requires a careful, concrete analysis of the individual case to see how and what factors — neurologic, personality and therapeutic — are interfering with the patient's ability to perform effectively in the prescribed task and generating a negative motivational state. The strength and the interaction of these factors determines whether poor motivation is manifested as a difficulty in getting involved, as poor performance or as striking regression in performance.

With information available as to what is interfering with the patient's performance it becomes possible to introduce more favorable therapeutic conditions for learning and thereby create a positive motivational state.

The continued use of the concept of "poor motivation" as a general explanation of a patient's failure in rehabilitation seems to us to be a real impediment to the proper exploration of the many

factors involved in the problem. In approaching a stubborn rehabilitation problem each of the authors independently has ceased thinking of motivation as the determining element. Instead we think in terms of what factors are creating stress and interfering with learning and of what can be done to lower the stress of frustration and promote the patient's ability to achieve his goal. This approach has focused our attention on the intimate connections among personality, stress, learning and performance⁴ and has exposed some of the complex inter-relationships of these mainsprings of human behavior. In time we hope that such growing knowledge will enable us to struggle more effectively with the problem of rehabilitation.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



The following notice was submitted for publication by Joseph B. Rogoff, M.D., Liaison Officer of the American Congress of Physical Medicine and Rehabilitation with the Food and Drug Administration:

"Four devices were alleged to be misbranded by false and misleading claims. One was promoted for use by chiropractors on the basis that restoring natural balance and poise and removing structural stresses of the body were a means toward achieving better health. The device was claimed to be effective in treating female conditions, hernia, tuberculosis, asthma, heart conditions, bladder irritations, broken arches, and infections of the ear, eyes, nose and throat. It consisted of 2 platforms on which the 'patient' stood and a control panel for tilting the platforms at varying degrees.

"The promoter of a so-called 'slenderizing salon' device said in his literature that its use would change body proportions, remove surplus inches in specific areas, keep the body firm and vibrant, relieve tension during the menstrual period, reduce weight, restore muscle tone, and aid in faulty elimination. The 'patient' was directed to place various portions of the body against rollers that were rotated by a motor-driven belt. A May 12, 1960 consent decree of condemnation entered by the Federal Court for the District of Minnesota provides for destruction of literature used by H. C. Fischer, doing business as Niblack Slenderizing System, Minneapolis, and for relabeling the product sold as the Niblack Home Pony, to comply with the Federal Food, Drug and Cosmetic Act."

★ *survey of selected literature* ★

This systematic abstracting and indexing of selected journals is made possible by a grant from the American Rehabilitation Foundation, a subsidiary of the Sister Elizabeth Kenny Foundation.

• **ACTA ORTHOPAEDICA SCANDINAVICA. Vol. 29 (Part 3) 1960.**

◇ **Osteochondritis in Congenital Dislocation of the Hip: A Clinical and Radiographic Study.** C. Lima; R. Esteve, and J. Trueta. pp. 218-233.

This study is based on the review of 184 cases of congenital dislocation of the hip, of which 90 showed signs of osteochondritis following the initiation of treatment. On the clinical and radiographic data collected, the authors describe three different types of osteochondritis.

Type I comprising 54 cases (65 per cent) shows changes first of the femoral epiphysis which spread to the femoral neck and acetabulum. Severe osteoporosis with small cavities, particularly at the periphery of the femoral head appear. Some permanent deformity may follow, particularly flattening of the epiphysis and increase in anteversion and varus of the femoral neck. Recalcification of the neck and the head tend to occur simultaneously. The average duration of the condition is 2.48 years.

Type II comprises 22 cases (26.5 per cent). In this category osteoporosis may be minimal but the effect of pressure on the femoral head is seen from the beginning. Local deformity of the head is frequent. The average duration of the condition is 4.06 years.

Only 7 cases of Type III were seen (8.4 per cent). They all show the radiographic changes typical of Legg-Perthes disease, particularly fragmentation of the femoral epiphysis. Average duration is 3.16 years and the permanent changes found appear similar to those of the Legg-Perthes osteochondritis.

The authors believe that Types I and III are caused by interference with the blood flow of the femoral epiphysis through stretching or extreme torsion of the posterior capsule of the hip at the point where the lateral epiphyseal vessels penetrate the femoral head. Manipulative treatment causes damage to these vessels much more easily than does reduction of the dislocated hip by progressive traction.

Fracture of the odontoid process of the axis. Nachemson, Alf. p. 185.

Dysplasia epiphysialis hemimelica. Recknagel, K. p. 237.

Operative method for correction of heavy flexional ankylosis of the knee joint with no loss of bone. Hadjistamoff, B. p. 247.

★ **ACTA ORTHOPAEDICA SCANDINAVICA. Vol. 29 (Supplement 42) 1960.**

◇ **Disturbances of Arterial Blood Supply to the Spinal Cord and Brain Stem Caused by Spondylosis, Disc Protrusions and Root-Sleeve Fibrosis.** Tore Stortebeker. pp. 1-17.

In this report some pathological conditions of the spinal cord and brain stem induced by local hindrance of arterial blood supply are discussed. Earlier experimental work gives evidence to the fact that pathologic changes identical with the picture of amyotrophic lateral sclerosis can be provoked by a slowly induced chronic hypoxemia of the spinal cord and brain stem.

The author gives the following explanation to the pathogenesis of amyotrophic lateral sclerosis. Disc protrusions or spondylosis with osteophytes might narrow the adjacent intervertebral

foramina. Especially the root-sleeve fibrosis produces a slowly developing partial compression of the corresponding radicular artery during its passage through the intervertebral foramen. This in turn induces a local chronic hypoxemia of the spinal cord with subsequent degenerative changes of the motor cells of the anterior horns (progressive muscular atrophy) and demyelination of the pyramidal tracts (symptoms of spasticity depending on the site of the lesion). A cervical disc protruding laterally gives a condition of chronic compression of the vertebral artery during its passage through the vertebral canal and consequently a deficient arterial blood supply to the motor nuclei of the medulla oblongata (progressive bulbar paralysis). Since cure of amyotrophic lateral sclerosis by conservative treatment always has failed the author suggests that decompression of the strangulated arteries by surgical intervention should be tried in suitable cases.



A.M.A. ARCHIVES OF NEUROLOGY. Vol. 2, Feb. 1960.

◇ **Survival of Sympathetic Nervous System After Spinal Cord Injury as Measured by Sweat Mechanism.** B. Boshes, and H. Blustein. pp. 163-171.

The survival of the sympathetic nervous system in 26 paraplegic patients was determined by the remaining function of the sweat mechanism. The paraplegias were of varying severity and duration and due to spinal cord or cauda equina lesions. Sweat was produced by three mechanisms: generalized heat, drugs (pilocarpine or metacholine), and spinal reflexes (bladder distention). The sweat reaction was brought out in color by the Minor iodine or the Guttmann quinizarin technic.

Thermoregulatory sweating can be abolished below a complete lesion. Often, however, the preganglionic fibers from the lowest intact roots synapse with enough distal postganglionic fibers to eliminate any heat sweating loss. Sweating was produced by drugs above and below all complete lesions and was more marked with complete than with incomplete lesions. Spinal reflex sweating was produced in all but one case in which an anterior and posterior rhizotomy prevented any afferent stimulus from reaching the isolated cord. This mechanism was present in one patient nine years after the onset of paraplegia. It was concluded that the sympathetic nervous system could survive at least this long.

◇ **Results of Chemopallidectomy and Chemothalamectomy.** T. H. Lin, and I. S. Cooper. pp. 188-193.

The results of chemopallidectomy and chemothalamectomy on 100 cases of Parkinsonism in patients 60 years of age or older were analyzed. It was found that age was a less determining factor of good results than was proper selection of candidates. Patients in the early stages of the disease, still able to carry on their full-time occupation and essentially independent in activities of daily living, were considered good candidates. Of these patients 83.3 per cent had excellent results; those candidates rated as fair had 65.2 per cent excellent results; and those rated as poor had 37.5 per cent excellent results. Overall good results were obtained in 75 per cent of the group. Mortality was three per cent which compared favorably with a younger age group mortality of two per cent. The average length of hospitalization was approximately two times greater in the studied group than in the compared younger groups.

Bilateral carotid artery occlusive disease. Groch, S. N.; L. J. Hurwitz, and F. McDowell. p. 130.

Glia, lipogenesis and formation of myelin. Korey, S. R. p. 140.

Recurrent cerebrovascular episodes. Denny-Brown, D. p. 194.

Diabetic neuritis (neuropathy). Aring, C. D. p. 211.



A.M.A. ARCHIVES OF NEUROLOGY. Vol. 2, Mar. 1960.

◇ **Ocular Myopathy.** R. D. Teasdale, and M. L. Sears. pp. 281-292.

Electromyographic studies were performed on the extraocular muscles of six patients with ocular myopathy. The possibility of hyperthyroidism, myotonic dystrophy, myasthenia gravis and diseases of the long tract motor pathways were specifically looked for and not found. The authors feel that the findings were indicative of primary muscle disease. Electromyographic studies were also performed upon the extraocular muscles of four normal patients and a discussion of these findings is presented and compared with those of ocular myopathy. With

slight involvement of the extraocular muscles, the amplitude and frequency of the discharges were indistinguishable from those of the normal. The potentials, which were reduced in amplitude, tended to fatigue and their rhythm was irregular. There was a significant decrease in the duration of the action potentials from the normal (0.76 msec. as compared with 1.43 msec.). In contrast to muscular dystrophy there was no tendency for increased polyphasic activity. No fibrillation or abnormal insertional activity was recorded.

◇ **Newer Concepts of Myelin Formation Correlated to Functional Changes.** R. M. Bergland. pp. 260-267.

Nerve conduction velocities in the sciatic nerve of chick embryos are correlated with myelin formation as determined by electron microscopy. Conduction velocities performed on the 10th through the 14th days of incubation remained constant. On the 15th day the velocities increased sharply and this correlated with the beginning of myelination of the axons. It is noted that though the conduction velocity remained constant from the 10th through the 14th days, the sciatic nerve trunks enlarged from 0.5 to 2.5 mg. in weight and from 5.0 to 13.0 mm. in length. Furthermore the axons increased from 0.3 microns to 1.0 microns in diameter, emphasizing the functional importance of myelin. Electron micrographs showing the dynamics of the interaction between the axon and the Schwann cell in myelin formation are also presented.

All epilepsy is one. Mackay, R. P. p. 237.

Observations on deep cerebral "localizations" of the tremor of Parkinson's disease. Mullan, S. p. 274.

Problems in anatomic analysis of lesions of the median longitudinal fasciculus. Christoff, N.; P. J. Anderson; M. Nathanson, and M. B. Bender. p. 293.

Multiple arachnoid diverticula. Teng, P., and N. Rudner. p. 348.



AMERICAN JOURNAL OF THE MEDICAL SCIENCES.

Vol. 239, April 1960.

◇ **Arterial Pulse Recording in Peripheral Vascular Disease.** A. Buzzi. pp. 469-477.

The evaluation of the trunk arteries such as the femoral, brachial and popliteal is currently performed by oscillometry. The author enumerates the limitations of this procedure as follows: (1) graphic recording is not uniformly available, (2) the sensitivity is low, (3) calibration is arbitrary, (4) the cuff used with the oscillometer includes more than one artery in the distal extremities, and (5) some regions cannot be adequately explored. The usefulness, in assessing the status of the larger arteries, of direct intraarterial pressure recording and of indirect recording of the pulse from the skin superficial to palpable arteries are demonstrated. Standard, readily available instrumentation and technic was used by the author for direct arterial pressure recording. The indirect recording was obtained by suitable amplification of the output of a special capacitance manometer placed over the artery in question.

While the former procedure yields both quantitative and qualitative information of value in localizing areas of severe sclerosis and stenosis, the procedure involved in obtaining the data is more complicated. The indirect pulse tracing on the other hand may be simply and easily obtained. Valuable qualitative information is yielded by this observation. The author gives many examples of the appearance of the tracings, thus obtained in normal and pathological states.

◇ **The Cardiovascular-Respiratory Effects of a New Xanthine Derivative in Chronic Pulmonary Emphysema and in Mitral Stenosis.** F. Barrera; J. C. Dominguez; R. L. Changsut; G. C. Regaldo; L. Arias, and J. Faura. pp. 487-491.

The new drug, X-D, 7-(w-piperidino-butanon-2-yl) theophyllin, was investigated for its effect on pulmonary ventilation and circulation. Nineteen patients undergoing cardiac catheterization were studied at rest [sic] and 30 minutes after administration of 0.1 to 0.2 g. Eight had advanced chronic pulmonary emphysema and 11 had uncomplicated mitral stenosis. The usual cardio-pulmonary parameters were observed. Control observations were made using a larger dosage (0.25 g.) of aminophylline. No statistical differences in the effects of the two drugs appeared. However, dosage of X-D was smaller and side reactions were less frequent than with

aminophylline. The drug increases alveolar ventilation and arterial blood pH. It reduces physiological dead space, arterial $p\text{CO}_2$ and both pulmonary and systemic vascular resistance. The authors do not give data on continued use of the drug in clinical trials.

Perspectives in the treatment of diabetes. *Duncan, G. G.* p. 397.



AMERICAN JOURNAL OF THE MEDICAL SCIENCES.

Vol. 239, May 1960.

◇ **Incidence of Hypothyroidism in More than One Member of a Family.** *Marshall Goldberg.* pp. 562-570.

The author investigated a series of 108 patients of proved or suspected thyroid deficiency. It proved possible to investigate the immediate family of 57 of these patients. The patients ranged from 15 to 50 years of age. Diagnosis of hypothyroidism rested on (1) history, (2) level of protein bound iodine, (3) electrometric record of Achilles tendon reflex, and (4) serum cholesterol and BMR. No patient was included who did not respond objectively and subjectively to treatment with thyroid hormone. Thirty-one patients included in 15 family groups comprised the final working group. The series show that two or more members of 15 families were represented in the 57 proved cases of hypothyroidism. This represents a multiple incidence per family rate of 26 per cent.

Figures for the incidence of thyroid deficiency in the population as a whole range from three to five per cent. Hereditary factors fail to explain the multiple incidence in this series since in the 15 such cases, husband and wife were involved in 13 cases, and parent and child in only two. The author suggests the possible etiological implication of the auto-immune mechanism to thyroglobulin and other thyroid antigens. Along this line the author points out that mumps occurred in the four of the 15 families in question less than one year prior to examination. This and other viral infections are suggested as possible causes for such an auto-immune reaction.

The author recommends investigation of thyroid status in members of families containing a known case of hypothyroidism. Among the diagnostic aids, the author stresses the value of the Lawson Kinemometer for detecting abnormality in the tendon reflexes.

◇ **The Cerebral Peripheral Circulatory Action of Nylidrin Hydrochloride.** *T. Winsor; C. Hyman, and F. M. Knapp.* pp. 594-600.

Studies were performed on 25 patients with arteriosclerosis involving the lower extremities and on 11 rabbits. The following parameters were observed in the studies on patients: pulse rate, cardiac output, clearance of I_{131} from calf muscle, calf flow by triple cuff plethysmography, peripheral resistance in the lower extremity and blood flow in fingers and toes by plethysmography. In the rabbit experiments, the following observations were made: muscle flow by drop counter in the femoral artery, renal plasma flow, cerebral blood flow by drop counter meter measuring internal carotid flow after tying off vertebral arteries and clearance of I_{131} from gray and white matter. The effects of treatment with nylidrin (1-P-hydroxyphenyl 2-methyl-3 phenyl-propylamino propanol hydrochloride) in humans were presented for each parameter by listing the relative change induced. The drug was administered by the intramuscular or intravenous route in dosage of 5 mg. Observations of parameters during a pre-drug control period were compared with those made during the period of maximal pulse rate after drug administration.

In the studies on humans, the most striking change (+ 75% mean value) occurred in calf muscle blood flow. Skin flow increased but little (+ 12% average for finger and toe). A moderate (+22%) increase in cardiac output and pulse rate ensued, blood pressure was but slightly affected and renal plasma flow decreased to 83 per cent of the control value.

In the rabbit experiments using drug dosage of 10 micrograms/kg/min femoral artery flow was increased by about 50 per cent, blood pressure was affected only slightly and cerebral blood flow was increased by 50 per cent.

In addition, clinical effects of the drug were studied in 25 patients. Intravenous and intramuscular injections were well tolerated. Oral administration produced no significant side effects. Clinical improvement was frequently seen.

Malignant disease in the aged: Review of 16 years' experience in a modern medical facility for the elderly. *Elias, E., and G. J. Lesnick.* p. 554.



AMERICAN JOURNAL OF THE MEDICAL SCIENCES.*(Index number). Vol. 239, June 1960.*

◇ **A Controlled Study of Trimethobenzamide (Tigan), A Specific Antiemetic.** A. L. Kolodny. pp. 682-689.

Preliminary reports have indicated that the new drug, trimethobenzamide hydrochloride was an effective antiemetic in laboratory experiments with few, if any, side effects and that there was a wide margin between therapeutic and toxic dosage. This study was carried out using double blind technic on 161 patients with nausea and vomiting of 1.2 days average duration from various causes. The drug was administered to 95 patients and the placebo to 66 patients. Two hundred mg. of the drug was given every six hours by oral capsule, intramuscular injection or rectal suppository. The results showed that nausea was controlled in 61 per cent of the patients and vomiting was absent in 83 per cent after therapy compared with negligible results after placebo. After treatment mild nausea remained in 30 per cent and mild vomiting in 13 per cent of the patients. Four per cent retained severe nausea and three per cent severe vomiting. The average interval between treatment and relief was 30 minutes and duration four to five hours. No significant side reactions were observed.

◇ **The Acute Effect of Ethanol Ingestion on Plasma and Urinary 17-hydroxycorticoids in Alcoholic Subjects.** B. Kissen; V. Schenker, and A. C. Schenker. pp. 690-705.

Several experiments were performed on 106 chronic male alcoholic patients of an age range 21 to 53 years. All experiments but one involved a study of the effects on corticoid plasma levels and/or urinary excretion of corticoids following the administration of a test drink (1 ml. of ethanol per kg. body weight diluted with an equal volume of citrus fruit juice). Adequate control observations were made. No significant difference was found in the steroid excretion of alcoholic and non-alcoholic subjects. All remaining experiments were carried out on the alcoholic patients. The results of these experiments may be summarized as follows. After ethanol ingestion early (one hour) diuresis ensues accompanied by increased excretion of 17-hydroxycorticoid and lower plasma levels of this steroid. Thereafter the urinary output declines while the plasma level increases to baseline levels in four hours. Urinary excretion remains low for 12 hours. Excretory and plasma levels of 17-hydroxycorticoids during water diuresis yields essentially the same picture. After ethanol with fluid supplement (250 ml. H₂O or saline each hour for four hours after ethanol) there is frequently a rise in plasma steroids of the 17-hydroxy configuration with no significant alteration in urinary output. Another sequel to ethanol ingestion is a significant drop in the eosinophil count. These results are interpreted as showing active adrenal cortical stimulation by ethanol. 17-ketosteroid levels in urine and plasma are not affected. The authors emphasize the importance of simultaneous observations on blood and urine levels in studies on the excretion of adrenal corticoids.

**AMERICAN JOURNAL OF PHYSIOLOGY. Vol. 198, May 1960.**

◇ **Restoration of Respiration by Nerve Anastomosis.** N. C. Jefferson; T. Ogawa; C. Syleos; A. Zambetoglou, and H. Necheles. pp. 931-933.

This paper presents the authors' final data on a long-term study of anastomoses of central and peripheral ends of various pairs of nerves innervating respiratory muscles. During operations on adult mongrel dogs, the phrenic and the long thoracic or the sixth intercostal nerves were sectioned. The distal stump of the phrenic was anastomosed to the central end of one or the other of the nerves mentioned by end to end suture. Upon recovery, the animals were followed to observe any functional restoration of the diaphragm. Previous work by these authors had shown that trophic maintenance but not functional recovery of the diaphragm could be established by anastomosing the central end of various nerves to the distal end of the sectioned phrenic nerve.

In the present case spontaneous recovery of diaphragmatic movement occurred in 20 weeks after surgery in most of the cases of intercostal-phrenic anastomosis. Restoration of diaphragmatic respiration was observed in only one out of three cases of long thoracic-phrenic anastomosis. In acute experiments on these animals, the evidence for functional recovery of the diaphragm was substantiated by recording nerve impulses distal to the anastomosis.

◇ **Influence of Elevated Venous Pressure on Flow and Composition of Renal Lymph.** S. J. LeBrie, and H. S. Mayerson. pp. 1037-1040.

Previous work by these authors had reported on the electrolyte and protein composition of renal lymph relative to that of plasma. Sodium concentration was found to be 11 per cent higher, potassium the same, chloride 27 per cent higher, and total protein 40 per cent lower than in plasma. In the present work, lymph was collected from the renal capsular lymphatics in anesthetized dogs before, during and after episodes of elevated systemic venous pressure. During the period of venous hypertension, renal lymph flow increased fivefold. No significant change in electrolyte or protein concentration in the lymph resulted from the elevated venous pressure except at the highest pressure employed (30-35cm. H₂O) when high protein levels were found. While the venous hypertension was maintained, the lymph flow frequently equalled or exceeded the urine flow from that kidney. Also during the procedure urine flow and sodium excretion decreased. In qualitative terms the authors present their findings in support of the countercurrent hypothesis of urine formation.

Supersensitivity to neostigmine and resistance to d-tubocurarine in mice with hereditary myopathy. Baker, N.; L. Wilson; W. Oldendorf, and W. H. Blahd. p. 926.

Effect of small electric currents on intravascular thrombosis in the visualized rat mesentery. Sawyer, P. N., E. E. Suckling, and S. A. Wesolowski. p. 1006.

Glomerular filtration and renal plasma flow during hypothermia. Kanter, G. S. p. 1044.



THE AMERICAN JOURNAL OF ROENTGENOLOGY.

Vol. 83, June 1960.

◇ **Serial Femoral Arteriography in Occlusive Disease; Clinical-Roentgenologic Considerations with a New Classification of Occlusive Patterns.** H. Haimovici; J. H. Shapiro, and H. G. Jacobson. pp. 1042-1062.

A technic of serial femoral arteriography is described with emphasis on its advantages over the single film method. A classification of occlusive disease in the femoral-popliteal system into nine arteriographic patterns is presented based on a survey of 91 unselected cases. An interpretation and evaluation of the various patterns are made.

The technic described encompasses the use of a specially designed and built automatic long-segment serialograph thus securing full-length multifilm visualization. The most frequent location of arteriosclerosis obliterans in the lower extremities is currently believed to be the superficial femoral artery in Hunter's canal, and most pronounced at the adductor magnus foramen. Mechanical factors are assumed to play a significant role. In this series 17.5 per cent of the cases were in Hunter's canal. The second most common site was the proximal popliteal artery. A thorough analysis of the results of 102 arteriograms in 91 patients is presented. This is accompanied by a good many fine illustrations, both line drawings and radiographs. The practical value of long-segment serial femoral arteriography is emphasized. Its special use in determining exactly the sites of segmental occlusion, the collaterals present and the type and extent of the run-off greatly aids the decision concerning arterial grafting.

Evaluation of vertebral venography. Nathan, M. H., and L. Blum. p. 1027.

Intravenous aortography; technique and clinical aspects. Greenspan, R. H.; E. F. Bernstein, and M. K. Loken. p. 1034.



ANNALS OF PHYSICAL MEDICINE. Vol. 5, May 1960.

◇ **Electromyography of Postural Muscles.** J. Joseph. pp. 185-186.

Electromyograph examinations of the muscles of the lower extremity were made in the stand-at-ease position. The subjects stood with their feet comfortably apart, the toes externally rotated 30 degrees, and the hands clasped behind the back. Surface electrodes were used. Continuous and somewhat variable activity was found in the calf muscles in the majority of subjects and no activity was seen over the tibialis anterior, quadriceps femoris, hamstrings, iliopsoas, and gluteus medius, minimus and maximus muscles. Deliberate forward swaying at the ankles resulted in hamstring activity, and backward swaying resulted in anterior tibialis

and quadriceps femoris activity. Flexing the arms forward at the shoulder also produced activity in the hamstrings.

◇ **Effects of Delay in Rehabilitation of Fractures of Tibia and Fibula.** J. G. Parish. pp. 203-210.

Twenty-six miners with fractures of the tibia and fibula were treated at a rehabilitation center after plaster casts were removed. The mobilization time, the number of weeks from removal of plaster until the patient was fit for discharge, varied depending upon the time of arrival at the rehabilitation center after plaster was removed. The mobilization time was nine weeks for those arriving at the rehabilitation center within three weeks after plaster removal, and 18 weeks for those arriving more than three weeks after plaster removal. The length of time it took after plaster removal for the patients to develop an ability to stand on the toes without support, to walk normally, and to run evenly or with a slight limp, also depended upon the time of arrival at the rehabilitation center. These tests were completed within seven weeks by those arriving within three weeks after plaster removal and in 16 to 17 weeks by those arriving after three weeks. The rate of recovery of calf muscle power depended upon the length of time after plaster removal that elapsed prior to admission to the rehabilitation center. Those who arrived at least one month after plaster removal recovered calf muscle power at a much greater rate than did those arriving two, three and four months after plaster removal. The rate of recovery for the two, three and four month group was essentially the same. Post-plaster edema and delayed recovery of calf muscle power was felt to be responsible for the longer mobilization time in those patients who arrived late.

Relationship between muscle force and the electromyogram in the stand-at-ease position. Nightingale, A. p. 187.

Results of rehabilitation and resettlement in rheumatoid arthritis. Harris, R. p. 194.

Suppurative arthritis. Brewerton, D. A., and C. W. Manning. p. 214.



CIRCULATION. Vol. 21, Mar. 1960.

◇ **Starling and the Concept of Heart Failure.** Sir George Pickering. pp. 323-331.

The author discusses the classic papers of Starling and his colleagues on the connection between venous inflow, ventricular output and venous pressure. He cites appropriate excerpts from their work and demonstrates clearly that even though they used a heart-lung preparation, their conclusions took us close to the interpretation of heart failure in man.

The author points out that Starling did not think of a single curve to explain the relationship between cardiac output and right auricular pressure. Starling stated clearly that the difference between a good heart and a failing heart was that for a given output the former was working at low diastolic volume and low venous pressure and the latter at high diastolic volume and venous pressure. Whether the cardiac output is greater or less than it is in normal individuals, as in emphysema or rheumatic heart disease respectively, the failing heart is working at a high venous pressure. This is the essence of cardiac failure in man.

◇ **Rehabilitation in Congestive Heart Failure.** Howard A. Rusk, and Menard M. Gertler. pp. 444-447.

In this report congestive heart failure is considered the consequence of failure of conversion of biochemical energy within heart muscle into mechanical energy for propulsion of blood. This failure may develop because of a defect in energy production or substrate availability; a defect in energy transportation; or a defect in energy utilization.

The first principle of rehabilitation is to place the heart in a situation where demands made upon it can be easily met. Other basic principles are: 1) complete patient evaluation, 2) individualized management of medication and handling of environmental factors, 3) discussion with the patient leading to an understanding of the nature, prognosis, and limitations of his illness, 4) elimination of the patient's fear of heart disease, and 5) encouragement of the patient to live the fullest life possible.

There is enough evidence now available on the energy requirements of various grades of work to place cardiac rehabilitation on a sound scientific and practical basis. In addition, evidence is mounting to show that exercise is effective as prophylaxis against coronary artery disease. The clinician must realize, however, that physical activity requires careful followup if it is to be used safely and effectively.

Pediatric aspects of congestive heart failure. Nadas, A. S., and A. J. Hauck. p. 424.

Congestive phenomena occurring in pregnant women with heart disease. *Burwell, C. S., and J. Metcalfe.* p. 430.

Unusual causes of heart failure. *Burchell, H. B.* p. 436.



CIRCULATION. Vol. 21, April 1960.

◇ **The Lewis A. Conner Memorial Lecture: The Performance of the Heart.** Louis N. Katz. pp. 483-498.

In this paper the author discusses three aspects of the work of the heart based on experiments on the isolated dog heart, heart-lung preparation, and an open chest preparation with the heart in situ.

The first aspect concerns the manner by which the contractile effort of the heart responds to the work load imposed upon it. Adjustments to load are brought about by dilatation, tachycardia, change in contractile power and distensibility produced by hormonal and reflex effects, and hypertrophy.

The second aspect concerns factors which determine the oxygen requirement of the heart as its performance alters. The product of arterial blood pressure and heart rate was found to parallel oxygen consumption over a wide range of blood pressures, heart rate, and cardiac output.

The third aspect concerns the manner in which the oxygen needs of the heart are met by adjustments in coronary flow and in the rate of oxygen extraction. The ratio of oxygen availability to oxygen consumption is altered by acidemia, hypercapnia, catecholamines, sometimes by undue stress, but not by hypoxia. The ratio of coronary flow to oxygen consumption is altered by all of the factors mentioned including hypoxia. Coronary arteriovenous oxygen difference and coronary venous oxygen content are reduced by hypoxia. Acidemia, hypercapnia, catecholamines and sometimes undue stress reduce the coronary arteriovenous oxygen difference but increase the coronary venous oxygen content.

◇ **Serum Lipoproteins in Patients with Intermittent Claudication and with Myocardial Infarction.** P. J. Nestel. pp. 522-525.

Serum beta/alpha lipoprotein ratios were estimated by electrophoresis in four groups of subjects. These comprised 44 males with intermittent claudication; 61 men who were matched for age with the previous group and who were clinically free of cardiovascular disease; 30 men who had recently had a myocardial infarction; and 30 men who led sedentary lives in a home for the aged but who were free of cardiovascular symptoms.

The highest mean serum beta/alpha lipoprotein ratio was found among the patients with intermittent claudication and was significantly higher than the ratios found among the other three groups. There was no significant difference in the ratios of the myocardial infarction group and the two control groups.

The author points out that fibrinolytic activity is markedly depressed in people with intermittent claudication but is normal in patients who have recovered from myocardial infarction. Patients with intermittent claudication may be more liable to occlusion in another arterial territory than are patients with angina pectoris. In addition the high beta/alpha ratio in patients with intermittent claudication may reflect the possibility that different factors govern the development of atherosclerosis in different arterial territories — extremities, heart, and brain.

Myocardial infarction in patients treated with sippy and other high-milk diets. An autopsy study of fifteen hospitals in the U.S.A. and Great Britain. *Briggs, R. D.; M. L. Rubenberg; R. M. O'Neal; W. A. Thomas, and W. S. Hartroft.* p. 538.

Social aspects of cardiovascular rehabilitation. *Becker, M. C.; W. Vasey, and J. G. Kaufman.* p. 546.



GERIATRICS. Vol. 15, June 1960.

Effect of nicotinic acid on blood cholesterol. *Chazin, B. J.* p. 423.

Unemployment experiences of older workers. *Sheppard, H. L.* p. 430.

Foster care plan makes old persons part of the family. *Hafrey, D. J.* p. 434.

Merano seminar on aging and social health. *Leake, C. D.* p. 440.

Medical aspects of chronic arterial insufficiency. *Fuller, B. R., and H. W. Johnson.* p. 444.

Psychotic and senile patients with ischemic heart disease. *Sanen, F.-J.* p. 449.

Lesions of the oral mucosa — special exhibit. *Perry, H. O., and S. A. Lovstedt.* p. 454.

Nutrition in the aged. *Skillman, T. G.; G. J. Hamwi, and C. May.* p. 464.

Clinicopathologic conference — spontaneous hypoglycemia with abdominal spindle-cell sarcoma. *Volk, B. W. Edited by Goldner, M. G., and B. Wainfeld.* p. 473.

Chemopsychiatric institutional care of the aged. *Kent, E. A., and L. Gitman.* p. 480.

Peptic ulcer in geriatric patients. *Friedman, A. I.* p. 487.



INTERNATIONALE ZEITSCHRIFT FÜR ANGEWANDTE PHYSIOLOGIE.

Vol. 18 (Part 3) April 1960. (*Arbeitsphysiologie*)

◇ **Static Work and Heart Rate.** *O. E. Hansen, and M. Maggio.* pp. 242-247.

The authors attempted to show the specific effect of static work on the heart rate when superimposed on a base line of dynamic work. In order to obviate any influence of psychic state on the heart rate, subjects were started on a bicycle ergometer at a predetermined work load, continued for about ten minutes, at which time both arms were raised to right angles while holding 2 kg. in each hand. The weights were maintained for 1.5 minutes in a position at right angles to the sagittal plane. Oxygen uptake and pulse rate were determined before, during and following the work. The pulse rate increased about 13 beats per minute immediately when static work began and reached a level of 14 beats greater than pre-existing rates about a half-minute later, remaining essentially unchanged during the remainder of the static work period. The increase of oxygen consumption induced by the static work was 440 cc. about 50 per cent of which was taken up during the static work period; the other half was taken up afterwards. The authors believe that the increase in pulse rate is not related to accumulation of metabolites, since it rises almost immediately and remains at about the same level throughout the static work, but rather is due to nervous regulation in response to some as yet unknown stimulus.

◇ **Pulse Rate During Work Performed Against Time Limits.** *J. Rutenfranz.* pp. 264-279.

The author attempts to demonstrate the influence of psychological factors on the pulse rate by having five young adult subjects, four females and one male, perform mathematical computations within sharp time limits. The first study allowed constant time intervals but presented problems of increasing mathematic complexity. The second consisted of increasingly more complicated problems to be solved in progressively less time. The third combination presented simple computations to be solved in progressively shorter periods of time. In the first study, the pulse rate increased almost immediately, then back somewhat from the initial increase, gradually returned to that level. During recovery it fell off but did not reach resting level within the next five minutes. In the second phase, there was an initial increase, slight lowering, then progressively increasing rate throughout the remainder of the computations. On cessation of the computations, there was an immediate rapid fall followed by gradually decreasing rate throughout the subsequent 10 minutes, but never reaching the pre-test resting rate. The third phase showed a rapid increase and then slight decrease followed by stabilization at an intermediate level throughout the computations, without a dramatic drop-off at the time the computations ceased, but rather a slow decrease to near resting levels ten minutes later.

Theory of recovery time in dynamic work. (*Text in German*). *Rohmert, W.* p. 191.

The effect of testosterone on musculature and circulation. (*Text in German*). *Hettinger, T.* p. 213.

Blood pressure homeostasis of rats fed tryptophane deficient and methionine deficient diets. (*Text in German*). *Gati, T.; J. Sos; J. Rigo; J. Hideg; F. Gelencser, and M. Endres.* p. 228.

Influence of experimental electrical training on skeletal musculature. (*Text in German*). Schleusing, G. p. 232.

Studies of the protein requirements of humans during work in hot environment. (*Text in German*). Gontzea, J.; P. Schutzesu, and S. Damitrache. p. 248.

The effect of amphetamine sulfate and meprobamate on reaction time and movement time. Rasch, P. J.; W. R. Pierson, and M. L. Brubaker. p. 280.



JOURNAL OF GERONTOLOGY. Vol. 15, Jan. 1960.

◇ On the Production of Osteomalacia by Dietary Means. J. F. McClendon; and J. Gershon-Cohen. pp. 26-31.

The authors define osteomalacia as a decrease in the ratio of bone salts to protein matrix as compared with a normal animal of the same age. On the basis of x-ray evidence, they state that low phosphate diets produce rickets in rats and low calcium diets produce osteoporosis. In the past, rickets-producing diets described in the literature have not produced osteomalacia perhaps for the reason that rats on low phosphate diets are hard to maintain into adult life.

A group of 30 rats which were used for this study were fed over a period of 100-200 days a diet which contained only 0.228 per cent phosphorus (of which only half was available because it was in phytin) and 0.022 per cent calcium but which was otherwise adequate for maximal growth of rats. The rats were divided into five groups and to the basic diet the following substances were added: (1) three per cent CaCO_3 ; (2) three per cent CaCO_3 plus one per cent SrCO_3 ; (3) three per cent CaCO_3 plus $\frac{1}{4}$ per cent $\text{BeCO}_3 \cdot 4\text{H}_2\text{O}$; (4) one per cent Na_2HPO_4 ; and (5) two per cent $\text{Ca}_3(\text{PO}_4)_2$. Thus the effects of the following diets were studied: (1) high calcium, low phosphate; (2) high calcium and strontium, low phosphate; (3) high calcium and beryllium, low phosphate; (4) low calcium, high phosphate; and (5) normal control.

At the end of each experiment, the rats were killed with ether, weighed and x-rayed. The left femur after being dissected out, boiled one minute in distilled water, cleaned under magnification and weighed immediately, was analyzed for ash and calcium content. The right femur was similarly prepared and aliquated for Kjeldahl nitrogen, from which protein content could be calculated.

The authors found that low phosphate diets deficient in vitamin D when fed for 100-200 days produce osteomalacia in the rat. Instead of using the microscope to determine the amount of decalcification, they resorted to chemical analysis, using the ratio of ash to protein. In normal rats this ratio was about two, but in rats with osteomalacia it was 0.5 to 1.5. In previous studies in osteoporosis, this ratio was found to be normal. Additions of strontium or beryllium, too small to produce effects by themselves, intensified the effects of the very low P/Ca ratio.

◇ Vitamin B_6 Deficiency in the Aged. E. Ranke; S. A. Tauber; A. Horonick; B. Ranke; R. S. Goodhard, and B. F. Chow. pp. 41-44.

In order to determine whether or not vitamin B_6 concentration in serum decreases with advancing age, as has been demonstrated for vitamin B_{12} and ascorbic acid, the authors made serum transaminase (SGOT) and xanthurenic acid excretion determinations after a tryptophane load test. They compared values obtained for young and old individuals and also observed the effects of subsequent administration of pyridoxine on these determinations.

The serum transaminase content in 60 young (average age 25 years) and 62 old individuals (average age 76 years), both male and female all of whom were in good health, was measured. It was found that the SGOT content was significantly lower in the sera of old individuals than in those of the young. No sex difference was observed.

The authors treated two groups of old individuals with 15 mg. vitamin B_6 daily for three weeks. In 14 persons such vitamin B_6 administration brought about an increase in the average SGOT level from 13.7 ± 1.05 to $18.7 \pm .94$; in six other persons there was an increase from 14.1 ± 0.77 to 20.5 ± 1.99 units.

The authors demonstrated that the *in vitro* addition to the sera of pyridoxal phosphate, the coenzyme of transaminase, raised the transaminase activity of the sera in both young and old individuals and that this increase was greater in the old subjects.

Vitamin B_6 deficient animals are less capable of completing tryptophane metabolism and demonstrate an accumulation of xanthurenic acid after a load dose of tryptophane. The authors

determined the 24-hour xanthurenic acid excretions in 20 young and 24 old people and found that the excretion of the old was about twice that of the young. However, 15 mg. vitamin B₆ administered daily to old people for three weeks promptly corrected this abnormally high excretion of xanthurenic acid.

An interesting side of this study is the possibility that a mild state of vitamin B₆ deficiency among the aged might have an effect in diminishing the absorption of vitamin B₁₂ and might bring about adrenal insufficiency as it has been shown in animal experiments.

Age changes in skinfold compressibility. Brozek, J., and W. Kinzey. p. 45.

Ego functions in the middle and later years: A thematic apperception study of normal adults. Rosen, J. L., and B. L. Neugarten. p. 62.



THE JOURNAL OF PEDIATRICS.

◇ **Voiding Urethrography: An Integral Part of Intravenous Urography.** J. W. Hope; P. J. Jameson, and A. J. Michie. pp. 768-773.

This is a well-illustrated report on the value of visualizing the lower urinary tract during intravenous urography. Two recent developments have made it possible to avoid retrograde studies in many children: the newer contrast media which give greater dye concentration and the use of carbonated beverages by mouth to push aside extraneous bowel shadows in the kidney area. The caliceal system and ureters can be outlined quite well. In addition, once there is dye-containing urine in the bladder, a film should be made during voiding to outline the urethra. Four case studies showing congenital "valves" in the anterior or posterior urethra or stricture are presented. This procedure should also have great value in adult patients with problems suggesting lower urinary tract pathology, such as stricture or diverticulum, since instrumentation, trauma, and secondary infection can be avoided.

◇ **Isolated Palatal Paralysis.** R. W. Olmsted; M. M. Halfond, and J. A. Kirkpatrick. pp. 795-799.

Case histories are presented demonstrating three patients with nasal speech which was difficult to understand. These children had difficulty feeding dating from birth manifested by regurgitation of milk through the nares. This problem gradually disappeared in later childhood. Physical examination revealed slight shortening of the soft palate in one child, normal size and position in two children. None of the three children showed drooling, and none had disturbance of the gag reflexes. Facial movements were of normal strength and were symmetrical. Only by visualizing the soft palate during phonation or by cineradiography was the palatal paralysis demonstrated. This report emphasizes the importance of suspecting paralysis and examining the child carefully, since each child had prolonged difficulty, each was seen by several physicians, but diagnosis was not made until late childhood at ages seven, eleven, and thirteen. Since speech therapy, surgical procedures, and prostheses may be very helpful to the child, early diagnosis and treatment might have prevented the secondary emotional complications which were of considerable magnitude in these instances. Isolated paralysis of the palate should be suspected even in the absence of other evidence of neurologic disturbances.

A reliable qualitative urine coproporphyrin test for lead intoxication in young children. Benson, P. F., and J. J. Chisolm, Jr. p. 759.

Craniofacial dysostosis, patent ductus arteriosus, hypertrichosis, hypoplasia of labia majora, dental and eye anomalies — a new syndrome? Gorlin, R. J.; A. P. Chaudhry, and M. L. Moss. p. 778.

Paralysis of the left diaphragm, left vocal cord, and aneurysm of the ductus arteriosus in a 7-week-old infant. Berger, M.; C. Ferguson, and J. Hendry. p. 800.

Prevention of rheumatic fever recurrences. Editorial. Kuttner, A. G. p. 847.



JOURNAL OF PHYSIOLOGY. Vol. 150, Mar. 1960.

◇ **The Excitatory Action of Acetylcholine on Cutaneous Non-Myelinated Fibers.** W. W. Douglas, and J. M. Ritchie. pp. 501-514.

The afferent discharge set up in the cutaneous branch of the cat saphenous nerve by acetylcholine, a pain producing substance, was studied. The acetylcholine was injected intra-arter-

ially. The afferent fibers that discharged were determined by studying the way in which the afferent discharge modulated the compound action potential produced by antidromic stimulation. Acetylcholine excited the bulk of the non-myelinated C fibers as well as the large and small myelinated fibers. The faster conducting C fibers, those sensitive to touch and to cooling, were more readily excited by acetylcholine. The slow conducting C fibers, for which no adequate physiological stimulus has been found, also discharged in response to acetylcholine. The action of acetylcholine is a direct one on the fibers and although unaffected by atropine, was readily abolished by hexamethonium. Touch sensitive fibers continued to respond to touch even after hexamethonium had abolished acetylcholine sensitivity. Sensitivity to acetylcholine, therefore, is not necessary in normal mechanosensitive fiber stimulation.

◇ **Effects of Phenol on Nervous Conduction.** P. W. Nathan, and T. A. Sears. pp. 565-580.

The short term effects of phenol on nervous conduction in the spinal roots of the cat were studied. The phenol was dissolved in either Myodil or Ringer-Locke solution. The solutions were applied to the trough produced by the laminectomies. Phenol caused either completely reversible or irreversible block of nervous conduction in myelinated and unmyelinated nerve fibers. Concentration, length of time of application, and the solvent used determined which effect took place. Regardless of solvent used, the concentration of phenol in aqueous solution in direct contact with the nerve fiber was the determining factor. The order in which fiber groups were blocked was the same as for local anesthetics, small fibers before large fibers. The blocks produced in large fibers were sooner reversible than the blocks produced in small fibers.

The measurement of metabolic and vascular responses in liver and muscle with observations on their responses to insulin and glucose. Dosekun, F. O.; J. Grayson, and D. Mendel. p. 581.

Potential fields initiated during monosynaptic activation of frog motoneurons. Brookhart, J. M., and E. Fadiga. p. 633.

The chemical excitation of spinal neurons by certain acidic amino acids. Curtis, D. R.; J. W. Phillis, and J. C. Watkins. p. 656.

Spontaneous activity in muscle fibers of the chick. Ginsborg, B. L. p. 707.



NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262 (No. 15) 1960.

◇ **Acute Gouty Arthritis Precipitated by Chlorothiazide.** A. Aronoff. pp. 767-769.

Chlorothiazide is a potent diuretic agent for oral use. It also has an important antihypertensive effect when given in conjunction with other hypotensive agents. In addition to its saluretic action there is a tendency to potassium depletion and ammonia retention. Chlorothiazide also interferes with the tubular secretion of uric acid resulting in an elevation of the serum uric acid. In this paper three cases in which acute gout developed on chlorothiazide therapy are reported. There was no previous history of gout in two of the patients. Symptoms developed with uric acid levels of 9.2 mg., 12 mg., and 5.8 mg. per 100 ml. Colchicine appears to be the treatment of choice and is effective in the acute stage though the uric acid level remains unchanged and chlorothiazide therapy is continued. Probenecid is said to be ineffective in lowering the serum uric acid while the patient remains on chlorothiazide.

Acute renal failure. Franklin, S. S., and J. P. Merrill. p. 761.



NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262 (No. 16) 1960.

◇ **Tendon Transfers in Ulnar-Nerve Injuries.** A. Versaci. pp. 801-804.

Ulnar-nerve severance destroys the innervation to the bulk of the intrinsic muscles of the hand, robbing it of its ability to perform the refined motions so necessary to the artisan and skilled worker. The typical hand in ulnar palsy exhibits clawing of the ring and little fingers, flattening of the transverse palmar arch, loss of lateral finger motions and weakness of pinch. In high nerve lesions, terminal phalangeal flexion of the ring and little fingers may be affected. Tendon transplantation has a definite place in the rehabilitation program of ulnar-nerve injuries. Tendons may be transferred when failure of reinnervation is encountered after nerve suture. If evidence of satisfactory regeneration is not present within 12 to 18 months, depend-

ing upon the level of the injury, tendon transplantation should be undertaken. When the strength regained by a particular muscle or group of muscles is insufficient to correct an important functional impairment, tendon transplantation may be used as an adjunct to improve the overall functional capacity of the hand.

The lumbricals flex the metacarpophalangeal joints and stabilize them when the extensor tendons act on the interphalangeal joints. When the joints are not stabilized in flexion, the extensor tendons hyperextend the metacarpophalangeal joints. The flexor tendons become tightened passively, causing the interphalangeal joints to fall into flexion. This can be prevented by transplantation of part of the flexor digitorum sublimis tendon through the lumbrical canal into the lateral bands. In cases of high-ulnar-nerve lesions the profundus muscle to the ring finger may be paralyzed. In such cases the extensor digiti quinti proprius tendon can be sutured to the lateral band of the finger.

Index finger abduction is very important and necessary to produce a firm pinch. It may be restored by transfer of the extensor indicis proprius tendon to the lateral band of the index finger. The thumb components to firm pinch affected by ulnar-nerve interruption are metacarpophalangeal-joint stabilization and thumb adduction. Both can be restored by transfer of the flexor digitorum sublimis tendon of the long finger to the insertion of the adductor pollicis tendon.

The climate for the cultivation of clinical research. *Strauss, M. p. 805.*



NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262 (No. 17) 1960.

◇ **Relation Between Spondylosis Cervicalis and Injury to the Cervical Spine and Its Contents.** D. Munro. pp. 839-846.

The purpose of this paper is to ascertain what relation acute trauma to the spine and its contents bears to spondylosis cervicalis. An analysis of 116 cases of spondylosis collected from 359 patients who were admitted to the Boston City Hospital for spinal cord injuries is presented. It was found that at least 33 per cent of patients of all ages who have sustained a sufficiently serious injury of the cervical spine and cord will be suffering from a pre-existing spondylosis cervicalis. The prognosis for life in the patient who is 60 years of age or over and has had a previously quiescent spondylosis as well as an injury to his cervical spine or cord is more serious at this age. It also seems as if the presence of spondylosis has no immediate or remote etiologic relation to symptoms of a cervical cord injury caused by an accident.

The author concludes that a serious injury to the cervical cord may occur in the absence of demonstrable bone damage or dislocation. The presence of spondylosis cervicalis was not a significant factor in causing either interference with the dynamics or a rise of cerebro-spinal-fluid protein above the normal level.

An acute cervical injury of significant proportions cannot be held to be the proximate or direct cause of the osseous, ligamentous, articular or neurologic signs and symptoms previously associated with or resulting from spondylosis cervicalis. There is also no tenable evidence to support the theory that injury to the cervical spine and its contents aggravates the symptoms of spondylosis.

Attempted surgical removal of accessible hard, bony ridges and osteophytes is a significant source of new postoperative disabling symptoms.

Modern therapy of acute cervical-cord injuries, even when associated with spondylosis, has reduced the mortality of these serious conditions by 37.5 per cent.

◇ **Infections of the Bones and Joints in Children.** T. Morse, and C. Pryles. pp. 846-852.

In this report a series of 76 cases of bone and joint infections in children under 13 years of age treated at the Boston City Hospital between 1946 and 1958 is reviewed.

It was found that all forms of bacterial infections of bones and joints are now less frequently seen, and that deaths from overwhelming sepsis are now rare. Also strikingly infrequent are foci of osteomyelitis in more than one bone in a given patient. The offending agent was usually the hemolytic staphylococcus aureus. Possible predisposing factors in the days immediately preceding the onset of illness were found in the histories of 41 of the children.

A positive culture from the local lesion was obtained in about 85 per cent of cases. Three blood cultures of 5 ml. each taken at two-hour intervals before therapy gave a positive culture in about 45 per cent of cases. On the average, the first positive x-ray studies were made 17 days after the onset of symptoms. The most common mistaken diagnosis was rheumatic fever.

The shortest hospital stay was five days, and the longest 348 days; the average hospital stay was 45.5 days.

Sixty-two patients received at least one antibiotic. Surgical procedures were carried out in 40 of the patients. Forty-eight had no complications when last seen, 15 had deformities of cosmetic importance only; three had functional deformity in the form of shortening of an extremity, and one had a permanently dislocated hip.

The authors recommend therapy with penicillin, erythromycin and chloramphenicol in full dosage after cultures are obtained. Therapy should be continued until all signs and symptoms of active disease have disappeared and roentgenograms give evidence of healing. Also adequate drainage should be used in suitable cases.



NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262 (No. 18) 1960.

◇ A Comparison of the Effect of Prednisone and Acetylsalicylic Acid on the Incidence of Residual Rheumatic Heart Disease. Combined Rheumatic Fever Study Group. pp. 895-902.

The objective of this study was to make clear if large doses of steroids given for 12 weeks are more effective than acetylsalicylic acid in reducing the incidence of residual rheumatic heart disease.

The dosage of prednisone was 60 mg. daily for three weeks in divided doses. It was gradually reduced during the following nine weeks. Total prednisone dosage was 3 gm. The dosage of acetylsalicylic acid was 50 mg. per pound of body weight in divided doses for nine weeks, 30 mg. per pound daily in divided doses for two weeks and 15 mg. per pound daily for one week.

Fifty-seven patients less than 12 years of age who had their first rheumatic attack occurring within 28 days before admission and who had clinical evidence of moderate to severe carditis were studied. It was found that after acetylsalicylic acid as well as prednisone therapy, a large proportion of patients with serious cardiac involvement in their first rheumatic attack recovered without residual rheumatic heart disease. In other patients, presenting signs indicative of carditis of similar severity, neither prednisone nor acetylsalicylic acid prevented residual rheumatic heart disease even if given in large doses for 12 weeks. The presence of an apical systolic murmur of Grade 3 intensity does not necessarily signify irreversible cardiac damage. The institution of therapy as late as 20 to 28 days after onset did not appear to result in a higher incidence of residual rheumatic heart disease.

In this study no adequate data were obtained to prove or disprove that steroids are superior to acetylsalicylic acid for the suppression of the acute manifestations of the disease. However the majority of the investigators conducting this study are of the opinion that prednisone suppresses the inflammatory reaction of the acute rheumatic attack more rapidly than acetylsalicylic acid and in patients with congestive heart failure may be life saving.

◇ Simplification and Improvement in Estimating Drug Dosage and Fluid and Dietary Allowances for Patients of Varying Sizes. A. Butler, and R. Richie. pp. 903-907.

The validity of applying the fortuitous proportionality of dosage to surface area or weight in estimating initial drug dosage or fluid and dietary allowances is demonstrated. It enables the clinician to discern relations between safe and effective dosage and tolerance more clearly than when dosage is calculated from the multiple doses per kilogram or multiple calorie per kilogram factors required by the lack of proportionality of dosage or caloric expenditure to body weight. Hence, use of square meters of surface area as a basis for adjusting dosage to size of patient both simplifies and improves clinical therapy.

Because prescription of drugs, fluids and foods is an important part in all medical practice, physicians would do well to appraise carefully the convenience and accuracy of current methods of estimating dosages. The present state of knowledge suggests that consideration of their clinical validity and usefulness rather than their "scientific validity" is more rewarding.

Diseases or clinical conditions associated with low leukocyte alkaline phosphatase. Tanaka, K.; W. Valentine, and R. Fredericks. p. 912.



NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262 (No. 19) 1960.

◇ **The Guillain-Barré Syndrome: The Need for Exact Diagnostic Criteria.** L. Osler, and A. Sidell. pp. 964-969.

The purpose of this paper is to clarify the diagnosis of the Guillain-Barré syndrome. The authors put forward the following criteria for the diagnosis of the disease.

The syndrome often begins one to three weeks after an infection, most frequently a respiratory one. The disease occurs at all ages and in both sexes, and the patient is afebrile when admitted to a hospital. Dyesthesias of the feet or hands or both usually precede the onset of paralysis. There is a rapid onset of symmetrical loss of power, commonly in the proximal muscles of the legs and frequently in the proximal arm muscles. Severe involvement of the trunk muscles is uncommon. The objective sensory loss is minimal and transient. Typically, it varies, even during the same day. The bladder is neither severely nor directly involved. Tendon reflexes are lost, or symmetrically diminished in milder cases. Cranial nerves, most frequently the seventh, are often involved on one or both sides.

Improvement usually begins before the third week and continues without relapse. The cerebrospinal fluid always shows a rise in protein content, without any marked rise in the number of cells.

There is complete functional recovery, without residual, in six months. Rarely, death from respiratory failure occurs in the early stages of the illness.

Ten cases of the Guillain-Barré syndrome fulfilling the mentioned criteria are listed. Two cases are described that did not conform to the criteria. Both cases superficially resembled the Guillain-Barré syndrome but in both cases sensory loss was very marked and in one case the white-cell count in the spinal fluid was 38000 per cubic millimeter. In both cases the course of the disease was prolonged and the patients continued to be severely disabled.

◇ **Demyelinating Diseases.** G. Schumacher. pp. 969-975.

This review provides clinicians with orientation in the newer fundamental data on the demyelinating diseases. According to several authors the characterizing feature of demyelinating disease is that the process attacks primarily and essentially the white matter of the brain although gray matter may also be affected.

On the basis of the opinions of numerous writers the following classification is given: *I Primary demyelinating diseases.* A. Cerebral lipidosis. B. Diffuse sclerosis. C. Disseminated sclerosis. D. Acute disseminated encephalomyelitis.

II Secondary demyelinating conditions. A. Wallerian degeneration. B. Metabolic disorders and deficiency syndromes. C. Anoxic anoxia. D. Exogenous intoxication. E. Endogenous intoxication. F. Myelinoclastic viral infections. G. Miscellaneous.

By intensive studies of the architecture of nerve myelin sheaths it is found that the myelin sheaths have a lamellar structure of alternating layers of lipid and protein. Fundamental observations have indicated that the layers of oriented lipid and protein are derived from the Schwann cell surface by an infolding process initiated at the time the Schwann cell envelops the outgrowing axon and that the sheath is laid down by the further growth of the infolded double Schwann cell membrane, which is wound around the axon layer by layer in a helical or circumvolute manner.

Though myelinated fibers in the central nervous system also have laminated myelin comparable to that of peripheral nerves they are rarely surrounded completely by the cytoplasm of the glial cell. From the present evidence the first stage of myelination appears to be a thickening of axons and envelopment by Schwann cells, one Schwann cell per myelin segment. Deposition of myelin lipid follows. There is a high concentration of lipids in myelin sheaths. These lipids disappear during demyelination as a result of a disturbance of lipid metabolism. According to the most recent classification nervous-system lipids comprise three chief groups namely cholesterol; sphingolipids, and glycerophospholipids.

It has been shown that myelin is not a definite chemical entity, but a complex of lipids and proteins. Though most proteins are present either as lipoproteins or as proteolipids, some proteins in the central nervous system may be present in free form.

The existence in nervous tissue of aminosugar containing polysaccharides has been emphasized since this is a structural component of connective-tissue substance. There is still a lack of agreement about the anatomical localization of this substance. Myelin metabolism as a possible approach to the problem of myelination and demyelination is briefly discussed.

Venous interruption for septic thrombophlebitis. Crane, C. p. 947.

The pulmonary pathologic physiology of persons who smoke cigarettes. Wilson, R.; R. Meador; D. Jay, and E. Higgins. p. 956.

NEW ENGLAND JOURNAL OF MEDICINE. Vol. 262 (No. 20) 1960.**◇ Effect of Repeated Fluoroscopic Examinations on 1480 Children with a Long-Term Follow-up Study. A. Birch, and D. Baker. pp. 1004-1008.**

In an attempt to determine the effects of ionizing radiation in serial fluoroscopies over a long period the records of patients attending the Rheumatic Cardiac Clinic at the New York Hospital were studied.

The records of 1480 patients, 746 female and 734 male, were selected. The number of fluoroscopies for each patient varied from three to 128. Patients were followed from three to thirty-seven years, with an average of 18 years. All patients were followed for a total of 26,314 patient years.

Two cases of cancer occurred. This was found to be below the expected incidence in the general population according to age and sex.

There was no statistically significant difference in the stillbirth rate from that of the general population, either in the overall group of 1087 births or in the 121 pregnancies during which fluoroscopy was performed.

The rate of congenital anomalies (2.1 per cent) was similar to that from the literature for the general population. The authors state that the absence of observed deleterious effect in a group this size should not be construed to mean that fluoroscopy entails no risk.

◇ Demyelinating Diseases. G. Schumacher. pp. 1019-1024.

Neurochemical aspects of demyelination are reviewed. Interference with enzyme systems may produce demyelination. Potassium cyanide, sodium acid and carbon monoxide can produce demyelination in animals. These agents appear to be metabolic poisons resulting in chemical anoxia through inhibition of the cytochrome oxidase system. Other chemicals acting as metabolic inhibitors, insulin hypoglycemia and anoxic anoxia also produce demyelination. It has been speculated that the normal maintenance of the integrity of a myelin sheath requires the presence of an enzyme system, interference with which causes the sheath to degenerate.

Certain abnormal nutritional factors seem to play a part in the demyelinating process. Interchange reactions of pyruvic acid metabolism are catalyzed by coenzymes derived from components of the vitamin B complex. This group is necessary for prevention of demyelinating neuropathies and subacute combined degeneration of the spinal cord.

Copper is a constituent of a number of enzymes of biological importance. It seems likely that copper ions are involved in metabolic events that lead to myelination and demyelination. Clinical studies have shown that susceptibility to a multiple sclerosis producing factor depends not only on age but possibly also on genetic composition.

Injection of normal nervous tissue may cause demyelination. Three types of chemical substances obtained from nervous tissue have been found to be encephalitogenic: proteolipids, proteins and a chemically unidentified component thought to be phospholipid.

Sudanophilic degenerative products from myelin sheath (cholesterol esters) occur in multiple sclerosis and several other demyelinating diseases. So-called prelipid degenerative products occur in leukodystrophy and in the lipidoses of the brain.

Finally the most important changes in chemistry of body fluids in relation to demyelinating diseases are listed.

**PEDIATRICS. Vol. 25, June 1960.****◇ Progress in Treatment of Tuberculosis. E. M. Lincoln, and P. G. Vera Cruz. pp. 1035-1041.**

One of the world authorities on tuberculosis reviews here the response to antimicrobial therapy in 420 children treated between 1944 and 1956, allowing at least three years for followup. The survival rates and elimination of permanent damage show steady improvement throughout the period of this study, being remarkably good in the last years of the study. A typical bacilli were cultured from only one child in the series. Initial resistance to streptomycin was encountered twice, and resistance to streptomycin developed during treatment in four other patients with chronic pulmonary tuberculosis, and in four patients with meningitis. Only one patient had organisms developing resistance to isoniazid. The importance of early recognition, surgical excision of necrotic areas either in the lungs or elsewhere, and prolonged followup are stressed, since present drugs and methods of treatment do not truly eradicate the disease.

◇ **The Serologic Response in Children to Asian Influenza-Virus Vaccine.** R. Batson, and R. Sanders. pp. 952-955.

The authors review previous reports on influenza-virus vaccine immunizations and report on a recent study on 37 children between one and 15 years of age. Forty-four per cent of adults receiving two injections of the monovalent Asian influenza-virus vaccine two weeks apart demonstrated fourfold or greater rise in hemagglutination antibody titer, when subsequently challenged with living virus. Forty-four per cent of those adults showing antibodies nonetheless developed a febrile illness, while seventy-eight per cent of the unvaccinated group became ill. Children given a single injection of polyvalent influenza-virus vaccine containing the Asian strain developed antibody response to the other antigens but not to the Asian strains. In the present study a monovalent vaccine containing 200 chick cell agglutination units per ml. was administered. Children under five years of age received 0.1 ml. intracutaneously or subcutaneously and repeated after one to two weeks. Children between five and 12 years of age received two injections, 0.5 ml. subcutaneously, at one to two week intervals. Those subjects over 13 years of age received a single 1 ml. injection. Hemagglutination antibody studies showed a rise in specific antibody titer in all but four subjects. No change in titer for other type A or type B strains was demonstrated. No systemic reactions of febrile responses were noted, although approximately two-thirds of the group had some local tenderness and pain. The authors recommend a vaccine containing 400 CCA units, given in two injections one to two weeks apart for all age groups when circumstances are such that immunization is desirable, but recommend against routine use of the vaccine.

The radioactive "fall-out" problem. Forbes, G. B. p. 929.

Encephalitis after yellow fever vaccination. Feitel, M.; E. H. Watson, and K. W. Cochran. p. 956.

Cockayne's syndrome. Macdonald, W. B.; K. D. Fitch, and I. C. Lewis. p. 997.



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against a physician, for to every man comes his hour.

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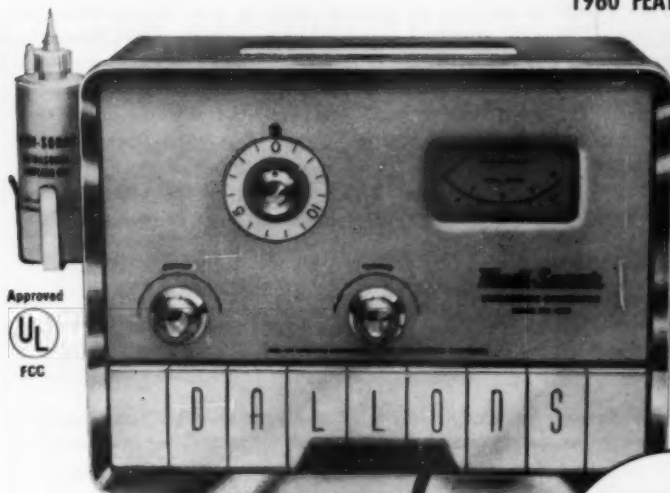
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Editor of the Month, PAUL A. NELSON, M.D., Cleveland

